IN THE

Supreme Court of the United States

OCTOBER TERM, 1942.

Nos. 369 and 373.

MARCONI WIRELESS TELEGRAPH COMPANY OF AMERICA,
Petitioner and Cross-Respondent,

vs.

THE UNITED STATES,
Respondent and Cross-Petitioner.

BRIEF FOR PETITIONER AND CROSS-RESPONDENT

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March, 1943.

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This action was brought by the petitioner and cross-respondent, hereinafter referred to as plaintiff, under the Act of June 25, 1910, as amended by the Act of July 1, 1918, 35 U. S. Code, Sec. 68, claiming compensation because of use by the United States of certain inventions covered by United States Letters Patent.

A final judgment was entered on April 6, 1942 by the Court of Claims of the United States, each side petitioned for a writ of certiorari, and this Court granted the petitions on December 14, 1942.

This brief will discuss the issues on both petitions, because the only issues on the cross-petition relate to one claim of a Marconi patent, other claims of which are among the subjects of plaintiff's petition. Such discussion will avoid unnecessary repetition.

Opinions of the Court Below

The Court of Claims on November 4, 1935, filed its findings of fact and conclusions of law (1 R. 7; 81 Ct. Cl. 671) and its opinion (1 R. 75; 81 Ct. Cl. 741), on the issues of the validity and infringement of the patents; and on April 6, 1942, filed its findings of fact, including among them what previously had been expressed as conclusions of law (1 R. 117) and its opinion (1 R. 157) on the amount of compensation due plaintiff (not yet reported).

There are now only two patents before this Court. Originally, there were four patents in suit: Marconi reissue 11,913, Lodge 609,154, Marconi 763,772 and Fleming 803,684, all of which expired in 1922 or earlier.

The Marconi reissue patent was held not infringed (conclusion of law, 1 R. 75, and finding of fact, 1 R. 117). The Lodge patent was held valid and infringed (conclusion of law, 1 R. 75, and finding of fact, 1 R. 117), the Court finding as reasonable compensation $34,827.70 with interest "as a part of the entire or just compensation" (1 R. 135). Both parties have accepted these decisions, so only the last two patents are in issue here.

The Marconi patent 763,772 was decided to be invalid, except as to claim 16 which was held valid and infringed (conclusion of law, 1 R. 75, and finding of fact, 1 R. 117). This decision is in conflict with the decisions in *Marconi* v. *National Electric Sig. Co.*, 213 Fed. 815 (D. C., E. D. N. Y.); *Marconi* v. *Kilbourne & Clark Mfg. Co.*, 9 Cir., 265 Fed. 644, affirming 239 Fed. 328 (D. C. Wash.); *Marconi* v. *British Radio, etc. Co.* (1911), 27 T. L. R. 274, 28 R. P. C. 18 (4 R. 2525; offered, 1 R. 186) on the corresponding British patent; and *Societe*

Marconi v. *Societe Generale, etc.*, Civil Tribunal of the Seine, on the corresponding French patent (4 R. 2622; offered, 1 R. 202).

The Court of Claims allowed compensation for use of claim 16 of the Marconi patent amounting to $42,984.93 with interest "as part of the entire compensation" (1 R. 156), defendant assigning as error the findings that this claim was valid and infringed, but not the amount awarded if the claim was rightly held valid and infringed.

The Fleming patent was decided by the Court of Claims to be not infringed (conclusion of law, 1 R. 75, and finding of fact, 1 R. 117), and the Court also said in its opinion that the patent was invalid because of delay in filing a disclaimer (1 R. 106, 107), but did not so find. These views are in conflict with *Marconi* v. *De Forest*, 2 Cir., 243 Fed. 560, affirming 236 Fed. 942 (D. C., S. D. N. Y.).

Jurisdiction

The final judgment of the Court of Claims, now sought to be reviewed, was rendered April 6, 1942 (1. R. 117).

The judgment was rendered in an action to recover compensation for the use or manufacture by or for the respondent, the United States, of apparatus embodying the subject matter of four letters patent of the United States. The action was brought under the Act of June 25, 1910, as amended July 1, 1918 (U. S. Code, Title 35, Section 68).

The jurisdiction of this Court is invoked under Sections 3 and 8 of the Act of February 13, 1925, as amended by the Act of May 22, 1939 (U. S. Code, Title 28, Sections 288 and 350). The time to file petition for certiorari was enlarged by order of the Chief Justice of this Court (3 R. 2523).

Statement of the Case

This suit was brought in 1916 by the Marconi Wireless Telegraph Company of America, a New Jersey corporation (1 R. 1), which had then been engaged for several years in the wireless business in this country (Brennan, 1 R. 191, *et seq.*, 2 R. 1347, *et seq.*; Sarnoff, 2 R. 1256, 1273).

In 1919, the Marconi Company conveyed substantially all its assets, except some claims, including the present one, to Radio Corporation of America, which claims the Marconi Company reserved for prosecution, the Radio Corporation advancing the money for such prosecution (1 R. 9-11). The Marconi Company was dissolved in 1920, thereafter acting by trustees in dissolution (1 R. 9), and the claims in the present suit are and for many years have been its only asset.

The taking of testimony commenced in 1917 (1 R. 184-453), and was suspended at the request of the Government until after the war (4 R. 2842-2854), when, because of many claims for the use of radio patents by the Government, an Interdepartmental Radio Board was appointed, consisting of representatives of the Department of Justice, the War Department and the Navy Department, to examine the various patent claims, consider questions of validity, infringement and extent of use, and determine what would be reasonable compensation.

The Board made an exhaustive study of the numerous radio patents submitted to it and thoroughly investigated the entire radio art, examining about 2,500 United States patents, hundreds of foreign patents, and hundreds of United States and foreign publications, and "finally came down to a real serious consideration of 149 patents. This consideration involved searches of the art, writing of long reports, receipt of briefs from claimants, hearings, more

briefs, revised reports, and then an accounting on those patents considered good, which were 27 in number, with much discussion following as to the methods of accounting and the effect of decisions thereon" (hearings before House Committee, 4 R. 2831, 2847; off., 2 R. 1098). On some patents "we did question the validity and made no allowance on them" (chairman of board, hearings before House Committee, 4 R. 2852; off., 2 R. 1098).

The Marconi claim on the four patents in suit was $6,000,000 (1 R. 6), and the Board, after careful analysis of the patents and apparatus (4 R. 2858; off., 2 R. 1098), made a formal report, recommending $1,253,389.02 as compensation (4 R. 2877; off., 2 R. 1098), for $26,399,490.60 of infringing apparatus (4 R. 2823), which is about 4.7%. This report, however, is not in any way controlling in the present litigation, having been made without prejudice.

The report was presented to Congress by the Secretaries of War and the Navy, and the Attorney General, but as no legislation was enacted to carry out its recommendations, the taking of testimony in the present suit was resumed in 1922 (1 R. 453), and concluded in 1930. As customary in Court of Claims cases, a Commissioner was appointed to consider the evidence which had been taken, but another Commissioner succeeded him, who filed a report in June 1933 and the Court of Claims then considered the questions of validity and infringement, there being reserved by stipulation the taking of evidence on the issue of reasonable compensation for the patents found valid and infringed (1 R. 175), and in November 1935 filed its findings, conclusions and opinion (1 R. 7, *et seq.*). Then followed the taking of evidence as to how much apparatus

had been used by defendant which infringed the Lodge patent and claim 16 of the Marconi patent 763,772.

The claims urged in this suit were based upon apparatus purchased and used by the Army and Navy prior to 1920, principally during the last World War. Plaintiff did not know the extent of the infringement and could ascertain and prove the facts regarding it only by records which in the main were secret records of the Army and Navy departments. Before plaintiff could secure the production of such records, it had to identify them from such source records as it possessed or were made available to it by defendant and third parties. Government departments then produced, at plaintiff's request, hundreds of army and navy contracts, together with the files relating thereto, all of which had to be examined to determine the nature of the apparatus called for under the contracts, and whether it was delivered and paid for (1 R. 121). About 100 of these contracts are listed in the record (1 R. 122, 123, 145). This was a lengthy process because naturally the various Army and Navy officers who from time to time were in charge of records relating to the contracts were not primarily interested in the *Marconi* law suit.

The Court of Claims points out (1 R. 174) that defendant in 1940 stated

> "The highly technical character of the subject-matter, the difficulty of assembling competent witnesses, and the time required for preparation by both parties are believed to be such as to indicate reasonable speed by both parties".

Litigation against the Government is not always a speedy process. As appears from *U. S.* v. *Citizens Loan & Trust Co.*, 316 U. S. 209, it took about twenty-three

years to collect a $10,000 insurance policy. In cases such as the present one, where the evidence is taken out of Court, the issues are many and complicated, and defendant relies upon witnesses from the Army and Navy departments, more time is required than in ordinary suits. The submission of evidence on the accounting closed in March, 1940, the Commissioner twice reopened the case to take more evidence, and in 1941 filed his report, the Court of Claims deciding the case in April 1942.

Questions Presented by the Two Writs

1(a) Validity of all claims in suit, except claim 16, of Marconi patent 763,772 (plaintiff's writ). The Court of Claims found that they were invalid.

(b) Infringement of all claims in suit, except claim 16, of the Marconi patent (plaintiff's writ). The Court did not make any ultimate finding of fact on this issue, but intimated in its opinion and findings (1 R. 44, 45, 95, 96, 101) that the claims were infringed, if the claims were valid.

2. Validity and infringement of claim 16 of the Marconi patent (defendant's writ). The Court of Claims found that it was valid and infringed.

3(a) Validity of claims 1 and 37 of the Fleming patent, especially in view of a disclaimer (plaintiff's writ). The Court of Claims said the claims were invalid for delay in filing the disclaimer (1 R. 106, 107), but did not so find.

(b) Infringement of claims 1 and 37 of the Fleming patent (plaintiff's writ). The Court of Claims found that they were not infringed.

The specifications of error on the two petitions present the above points.

Specification of Errors on the Two Writs

Plaintiff in its brief on the petition for a writ urged the following errors by the Court of Claims:

(1) In holding that claims 1, 2, 3, 6, 8, 10 to 14, and 17 to 20 of Marconi patent No. 763,772 were invalid;

(2) In holding that the subject matter of said claims lacked invention;

(3) In holding that the subject matter of said claims, or certain of them, was anticipated in the prior art;

(4) In failing to hold that said claims of Marconi patent No. 763,772 involved invention, that they covered new and useful subject matter, and that Marconi was the first inventor of the subject matter thereof;

(5) In failing to hold that said claims were valid;

(6) In failing to make the ultimate finding of fact that said claims of Marconi patent No. 763,772 were infringed by the apparatus described in the Special Findings of Fact of the Court of Claims, Nos. XLVI, XLVIII, XLIX, and L, of November 4, 1935 (81 C. Cls. 705-710);

(7) In failing to enter a judgment awarding to petitioner compensation for the manufacture and use by and for the respondent of apparatus utilizing the subject matter of claims 1, 2, 3, 6, 8, 10 to 14, and 17 to 20 of Marconi patent No. 763,772;

(8) In failing to hold that claims 1 and 37 of Fleming patent No. 803,684 involved invention, that they covered

new and useful subject matter, and that Fleming was the first inventor of the subject matter thereof;

(9) In failing to hold that said claims of the Fleming patent were valid;

(10) In holding that said claims of Fleming patent No. 803,684 were not infringed by the apparatus described in the Special Findings of Fact of the Court of Claims, Nos. LXXV, LXXVI, LXXVIII, and LXXIX, of November 4, 1935 (81 C. Cls. 735-740);

(11) In failing to hold that said claims of the Fleming patent were infringed by the apparatus described in said findings Nos. LXXV, LXXVI, and LXXIX, and that claim 1 of said patent was infringed by the apparatus described in said finding No. LXXVIII;

(12) In failing to enter a judgment awarding to petitioner compensation for the manufacture and use by and for the respondent of apparatus utilizing the subject matter of claims 1 and 37 of Fleming patent No. 803,684.

Defendant in its petition for a writ urged the following errors by the Court of Claims (defendant's cross-petition for writ, p. 10):

(1) In finding as an ultimate fact that claim 16 of the Marconi patent was valid and was infringed, without first determining its scope in view of the prior art.

(2) In failing to make a finding of fact as to the particular advantage achieved by the shunt condenser in the open antenna circuit of the Marconi patent, and in making a finding of infringement in the absence of such finding.

(3) In failing to find as a fact that the disclosure of the Marconi patent upon which claim 16 is based did not possess the principal advantage of cross-petitioner's structure but possessed a different advantage not used by cross-petitioner.

(4) In basing compensation upon the principal advantage present in cross-petitioner's structures, when such advantage was not disclosed or attained in the patent in suit.

(5) In not revising its findings of fact to conform to the entire evidence in the case where evidence necessarily admitted in the accounting proceedings, to establish a basis for compensation, disclosed incompleteness and error in the findings of fact theretofore made in relation to the infringement of claim 16 of the Marconi patent (No. 763,772).

Summary of Argument

1. This Court can review questions of law, including whether there is a lack of substantial evidence to sustain a finding of fact, whether an ultimate finding or findings are not sustained by the findings of evidentiary or primary facts, and whether there was a failure to make any finding of fact on a material issue.

2. The broad claims of the Marconi patent, which the Court of Claims decided were invalid for want of invention, are valid. The contribution of the Marconi patent to the practical art was of great value, it was made in the obscure and mysterious pioneer days of wireless communi-

cation, no one had previously taught or employed the principle of the patent, and the opinion in 1935 of the Court of Claims that this principle should have been obvious in 1900 to those then skilled in the art was erroneous.

3. The broad claims of the Marconi patent were infringed, and the Court of Claims should have so found, sufficient basis for such finding being present in the opinion and findings of that Court.

4. Claim 16 of the Marconi patent was valid and was infringed, as the Court of Claims rightly found. This claim describes a specific connection of elements for using the broad invention of the other claims, which connection was new and highly useful.

5. The Fleming patent was the pioneer patent in the radio tube art and its principles have been widely employed. The Court of Claims should have found the claims in suit valid over the prior art, instead of failing to make any finding on this point.

6. The Fleming patent was infringed by detectors, amplifiers, and oscillators, using three-electrode tubes and the Court of Claims was wrong in finding that there was no such infringement.

7. The Fleming patent was not invalid because of unreasonable delay in filing a disclaimer, and the Court of Claims should have so found, instead of failing to make any finding on this point and saying in its opinion that the patent was invalid for such reason.

ARGUMENT

I. This Court can review questions of law, including whether there is a lack of substantial evidence to sustain a finding of fact, etc.

The Act of February 13, 1925, U. S. Code, Title 28, Section 288, was amended by the Act of May 22, 1939, to authorize this Court in cases before it by certiorari to the Court of Claims

> "to review, in addition to other questions of law, errors assigned to the effect that there is a lack of substantial evidence to sustain a finding of fact; that an ultimate finding or findings are not sustained by the findings of evidentiary or primary facts; or that there is a failure to make any finding of fact on a material issue" (Act of May 22, 1939).

Prior to this amendment this Court could not review such matters, as was held in *U. S.* v. *Esnault-Pelterie*, 303 U. S. 26 (January 31, 1938):

> "The argument that the Government is precluded from obtaining the sort of review which is permissible in this Court, when there is a conflict between circuit courts of appeals as to validity and infringement of patents, and the questions are submitted upon the evidence taken in the District Court, is unavailing, for the result is due to the procedure which has been established by the Congress for the determination of claims against the United States" (p. 32).

Thereafter the Act was amended, as above set forth, to permit such review.

In the present case, there was substantially the same evidence before the Court of Claims as there was before

the circuit courts of appeals with which it disagreed. The vital issues are whether the patents, written contracts between the patentee and the Government, should be sustained as enforceable, and whether their meanings are such that the complained of apparatus are infringements of the legal rights conveyed by the patents. The only questions presented by the two writs are questions as to the correctness of the decisions by the Court of Claims, on the record before it, and its failure to make findings of fact upon material issues.

II. The Marconi patent 763,772 was valid as to the broad claims.

The Court of Claims in 1935 decided that the Marconi patent was invalid, except as to a narrow claim 16 (1 R. 75), because the Court thought that in 1900, when Marconi made his invention, "one skilled in the art", having knowledge of the Tesla and Lodge patents and the Stone documents, would make the same invention (1 R. 99).

It may be helpful here to state briefly the nature of wireless communication.

A. The nature of wireless communication.

The nature of wireless communication is explained in the record (Waterman, 1 R. 309 *et seq.*) and may be briefly described as follows.

Wireless communication is by the so-called ether, which serves as the medium through which wireless waves travel from a transmitting station to a receiving station. The ether (wireless) waves, often termed Hertzian waves, because of the 1888 discoveries of Hertz, are of the same nature as light waves, heat waves, and X-rays, their different effects

being due to the fact that the lengths of the waves are different.

A wireless transmitter is like a lighthouse, emitting light of an invisible nature, which is intercepted by a receiving station, where is absorbed and used the minute portion of energy reaching the station. The transmitter produces waves in the ether, which waves radiate out from the transmitting antenna, and are intercepted by receiving antennas.

Each signal radiated from a transmitting, or sending, station is made up of either a series of groups or a train of waves, of high or radio frequencies (from about 15,000 up to several millions of cycles per second), which are interrupted or modified in accordance with some signal at an audio frequency (below 15,000 cycles per second)—telegraph dots and dashes, sound waves, etc. During the accounting period, the signals were almost exclusively telegraph signals. The radio waves may be either one of two kinds: spark waves (created by a series of electric sparks) or continuous waves.

In the case of spark waves, each spark creates a comparatively short train of radio waves, and each telegraph signal, whether dot or dash, comprises a group of sparks, a short group for a dot and a longer group for a dash. In the case of continuous waves, each signal is made up of a train of radio waves, the length of the train determining whether the signal is a dot or a dash. Spark waves can be heard (detected) at a receiver by providing apparatus which is responsive to each group of waves, since the group-frequency is always an "audio" frequency, that is, a frequency within the range of frequencies that are audible to the human ear. Continuous waves must be modified either at the transmitter or at the receiver, so that each train of waves is made to vary at an audio frequency.

Audio frequencies, from about 15 cycles to 15,000 cycles per second, are too low for effective communication through the ether; therefore, the signals must be "carried" by high or wireless frequency waves.

Currents of radio frequencies are impressed upon the transmitting antenna, the currents produce waves of corresponding frequency in the surrounding ether, and the waves spread out in all directions.

At the receiving station, a minute portion of the ether waves is intercepted by another antenna, thereby producing radio frequency currents in the circuits of the receiver, which currents have the same frequency characteristics as the waves (and as the currents at the transmitting station). In the case of spark waves, the radio currents are rectified or otherwise integrated into the group or audio frequency, and the resultant currents applied to some kind of device which is responsive to the audio frequency so that the original signals may be detected. In the case of continuous waves, the radio currents are modified or broken up at audio frequencies so that, while the waves are being received, an audible or other indication of that fact enables them to be detected.

As is apparent from the foregoing, the receiving process is essentially the reverse of the sending process. Simply, in sending, radio frequency currents are produced and are broken up into signal frequencies; these currents are applied to an antenna and the signal-carrying radio waves are radiated. In receiving, the ether waves are applied to an antenna to produce signal-carrying radio frequency currents; the signals are then separated from the radio currents to obtain signal currents, which are used to operate an indicator.

B. The state of the wireless telegraph art prior to the Marconi patent.

The history of the art prior to the Marconi patent is well stated in the opinion in *Marconi* v. *National El. Signalling*, 213 Fed. 815 (D. C. E. D. N. Y.), the latter opinion being referred to with approval in the *Kilbourne & Clark* decisions, 265 Fed. 665 and 239 Fed. 329.

Marconi in 1894 learned of the Hertz 1888 experiments and in 1896 filed an application in the United States, upon which was granted the patent which was reissued as 11,913. That patent, formerly in suit, described a sending station and a receiving station, without any tuned circuits.

This system would operate, but only at short distances, because there was too much waste of energy. The transmitting antenna would quickly, and not persistently, radiate the energy applied to it, with the result that the train of ether waves would be too short instead of being sustained. And at the receiving station, the antenna likewise would quickly absorb the received waves, instead of storing them up, and the antenna also would receive undesired waves from other transmitting antennas (Waterman, 1 R. 328 *et seq.*; *Marconi* v. *National*, 213 Fed. 847). The Lodge patent formerly in suit was an improvement, both the transmitting and the receiving antennas being tuned with inductance, so that each would vibrate longer and the receiver would be more selective (inductance in an electrical system is the same as inertia in a physical system). But even with the Lodge patent, signalling to only short distances, about eighty miles, was possible before the invention of the Marconi patent 763,772, which enabled communication in 1901 over a distance of more than 6,000 miles (Marconi, 1 R. 532; *Marconi* v. *National*, 213 Fed. 848).

Patents for Marconi's second invention were granted in England, France and this country, which were sustained by the courts in bitterly contested litigation. And the United States Patent Office did not casually grant the patent.

C. The Patent Office history of the Marconi patent.

The application for the Marconi patent received a very intensive and almost hostile examination by the Patent Office, and was granted only after unusually careful investigation. This was not a case where a patent application slipped through with only slight attention by the Patent Office.

The application was filed in November 1900, and was rejected in December on Lodge (British patent corresponding to Lodge 609,154, formerly in suit) and Marconi 586,193 (which became reissue 11,913). The application was amended in details unimportant here, and the Patent Office examiner then required explanation of the operation of the two transmitting circuits (action of August 12, 1901; 5 R. 3985; off., 2 R. 1226), because even he, although an expert in the wireless art through his study of many patents, did not understand how it could operate (the Court of Claims in 1935 considered the Marconi system simple and obvious). Some detail amendments were made and the operation of the system explained to the Patent Office examiner (*id.*, p. 3989).

In February, 1902, the application was rejected on Lodge and several Marconi, Braun and other patents (*id.*, p. 3992), an affidavit of Marconi being submitted in reply that Marconi had not made the invention when he invented his earlier patent, 627,650, etc. (*id.*, p. 3999),

as Marconi also testified (1 R. 562, 563). The claims were then rejected on the Tesla patent 649,621, a division of the Tesla patent 645,576 (*id.*, p. 4002).

This rejection was on June 3rd, 1902 and the one year period then allowed for reply elapsed without reply. On October 6, 1903, the Commissioner of Patents was petitioned to permit a reply because of absences of Marconi, etc., which was opposed by the Examiner, denied by the Commissioner, reconsideration asked, upon the basis of affidavits by Marconi and his attorneys, and granted in March 1904 (*id.*, pp. 4066, *et seq.*).

The Patent Office then rejected some claims on Stone 714,756, allowing other claims (*id.*, p. 4068), the applicant amended some claims and cancelled others (*id.*, p. 4070) and the patent was granted.

These Patent Office proceedings are referred to by the Court of Claims in its findings (1 R. 38, 55) and in its opinion (1 R. 94), pointing out that four claims in the application were cancelled because of the Stone patent, the present claims 4, 5 and 7 of the patent being substituted. But those claims are not in suit and the cancellation is not material to the question of whether the claims in suit are valid or are infringed. Marconi made broad claims to tuned circuit apparatus, which claims are in suit, and also narrower claims, and the examiner allowed the claims over the Stone and other references.

It is plain from this brief summary that the Patent Office gave very careful and thorough consideration to the Marconi application before finally granting it. And while it is recognized that the conclusions of the Patent Office that a patent should issue to Marconi for what he disclosed, different from the earlier Marconi, Lodge, Tesla,

MARCONI AND TESLA SYSTEMS

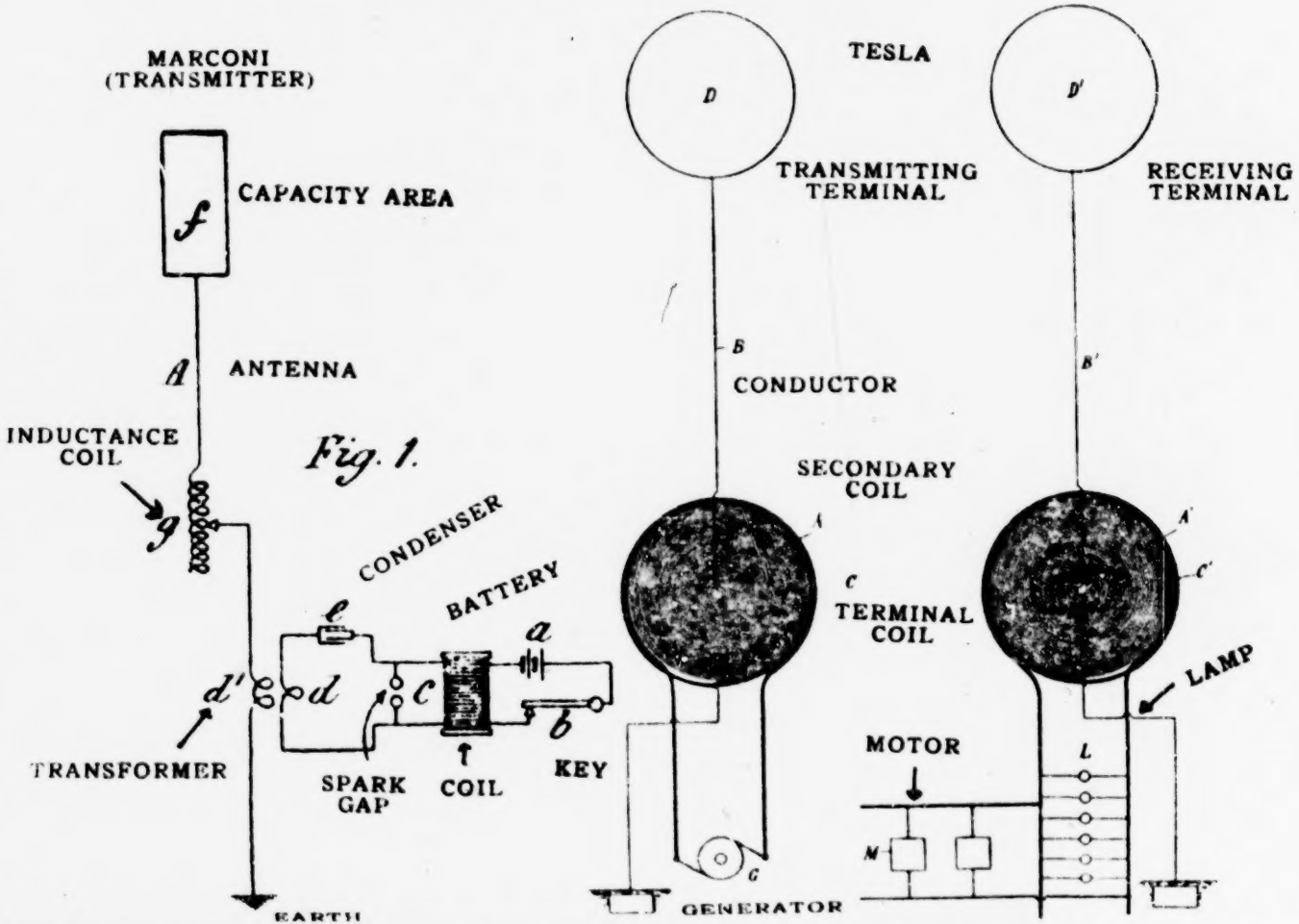


Fig. 1.

18-a

and other patents, is not controlling on the courts, surely the decisions of that administrative body of experts are entitled to some weight.

D. A description of the Marconi patent.

The Marconi patent (4 R. 2588; off., 1 R. 186) discloses transmitting and receiving circuits. For convenience, there are reproduced on the opposite page, diagrams of the Marconi transmitter and of Tesla patent 645,576, relied upon by the Court below.

Referring to Marconi's Fig. 1 (the transmitter), there are two circuits in which the radio frequency currents flow: the antenna circuit (elevated wire connected to ground, containing an inductance coil, g, and one coil, d', of a two-coil transformer) and the oscillation producing circuit (other coil, d, of the transformer, condenser, e, and spark gap). When the telegraph key, b, is pressed, current from the battery, a, flows through the primary of the induction coil, c, being broken up unto pulses by a vibrator (not shown in this patent but shown and described in the reissue patent 11,913; 4 R. 2567; off., 1 R. 190).

The pulsating current is transformed to a much greater voltage by the induction coil, c, and applied to the spark-gap circuit where, by the action of the elements therein, one group of radio frequency oscillations is produced by each pulse of battery current. The oscillations are then transferred to the antenna circuit and radiated therefrom as ether waves. Thus there are two separate radio circuits, the oscillation producing circuit and the antenna circuit. The antenna is a wire with widely separated ends; as the ends are not connected together, the antenna circuit is referred to as an open circuit. The oscil-

lation producing circuit is closed. The open and closed circuits are tuned to the same frequency.

The receiving system of Fig. 2 also has an open circuit and a closed circuit, tuned to the same frequency. The antenna circuit is open like the antenna circuit of Fig. 1, with the addition of a shunt condenser h (subject of Marconi claim 16) and some details unimportant here. There is a closed circuit, coupled to the antenna circuit by a two-coil transformer (pat. p. 2, l. 77 *et seq.*), to which are connected various things which enable the signals to be detected, such as "a telegraphing instrument or a printing device" (pat. p. 2, l. 113). Other detectors are also mentioned (p. 2, l. 56, *et seq.*)

The patent is plain in its description of the invention (Waterman, 1 R. 338 *et seq.*). As stated on page 1, ll. 37-55, the transmitter includes "a persistent oscillator, and a good radiator" (the oscillation producing circuit and the antenna circuit), and the receiver has "a good absorber of electrical oscillations, while a device responsive to electric waves, such as an imperfect contact or a device for operating the same, is included in a circuit" (the antenna circuit is the "absorber"). Marconi tunes the two circuits at the transmitter (and also at the receiver) "to be the same or octaves of each other" (pat., p. 2, l. 128; p. 3, l. 12 *et seq.*).

Again

> "The illustrated arrangement of parts at a transmitting-station enables much more energy to be imparted to the radiator f, the approximately closed circuit of the primary being a good conserver and the open circuit of the secondary being a good radiator of wave energy. My experiments have demonstrated that the best results are obtained at the transmitting station when I use a persistent oscilla-

> tor—an electrical circuit of such a character that if electromotive force is suddenly applied to it and the current then cut off electrical oscillations are set up in the circuit which persist or are maintained for a long time—in the primary circuit and use a good radiator—i.e., an electrical circuit which very quickly imparts the energy of electrical oscillations to the surrounding ether in the form of waves—in the secondary circuit" (pat. p. 2, ll. 6-25).

Transmitting systems prior to Marconi included the spark gap or other means for producing oscillations (high frequency currents) in the antenna circuit, which arrangements reduced the current in that circuit, because of the resistance of the spark gap. Marconi removed the spark gap from the antenna circuit and put it in an auxiliary circuit, which could be tuned to a high degree, thus greatly strengthening the oscillations produced. Thus two of the necessary functions of a transmitting system were greatly improved, namely, the production of oscillations and the radiation into space of ether waves caused by the oscillations. More energy can be produced in a closed circuit than in an antenna circuit, which has great resistance and little capacity, while the closed circuit is not so limited, and also, by reason of the resonant nature of the circuits, the energy can be efficiently transferred from the closed circuit to the open antenna circuit while the latter is radiating the ether waves into space (Waterman, 1 R. 347, 348).

In the similar two circuits of the Marconi receiving system, the tuning, which was essential in order to build up by resonance the extremely weak received signals, and also to discriminate against undesired electrical energy, caused by atmospheric conditions or undesired stations, was greatly improved.

The invention is well described in the British decision (4 R. 2525) and in the *National* opinion, 213 Fed. 847, 848. It immediately went into wide use, continued, with alterations only in the auxiliary apparatus, in almost exclusive use throughout the entire period covered by the record in this case, and has been appraised as one of high order by all courts which passed upon it in the early days of wireless; *National* case (213 Fed. 841), a "conspicuous advance in wireless telegraphy" (p. 858); *Kilbourne & Clark* case (239 Fed. 328), "a real accomplishment" and the ideas involved in the patent "have proven of great value to the world" (pp. 335, 342); High Court of Justice, Chancery Division, "an entirely new and useful result" (4 R. 2557); and the Civil Tribunal of the Seine, in France, "a new and very important industrial result" and "a wonderful conquest" (4 R. 2641) and "the Marconi patent stands out as an unassailable monument until new discoveries are made" (4 R. 2674).

E. The claims of the Marconi patent.

The Court of Claims correctly points out (1 R. 32) that the claims in suit may be divided into three classes, transmitter claims 1, 3, 6, 8, 11, and 12, receiver claims 2, 13, 14, 16, 17, 18 and 19, and combined transmitter and receiver claims 10 and 20. All these claims, except claim 16 for a specific type of receiving circuit, were held invalid by the Court of Claims, because of certain Tesla and Lodge patents and Stone documents (opinion, 1 R. 99).

In addition, the Court said that receiving claims 2, 13, 18 and 19 were also invalid, because they were not limited to the circuits being in tune with each other, and were anticipated by an earlier Marconi patent 627,650 (finding LIX, 1 R. 57). This was erroneous, because the descrip-

tion in the specification states that the circuits are so tuned, and claims are read in the light of the specifications, especially when they refer to them, as do the claims here, *Seymour* v. *Osborne*, 11 Wall. 516, 547; *Carnegie Steel* v. *Cambria*, 185 U. S. 403, 432. To the same effect is *Marconi* v. *Kilbourne & Clark*, 239 Fed. 328, 342 (D. C., Wash.), stating with respect to the Marconi patent:

> "The application not being for the principle of resonance or tuning, or such foundation as a scientific fact, reference to specification may be made for interpretation of claims made. *Tilghman* v. *Proctor*, 102 U. S. 707, 26 L. Ed. 279."

Upon such reference being made, it is plain that these specific claims describe the tuned circuits of the Marconi patent, and were valid, as indeed the Patent Office concluded in allowing them over the earlier Marconi patent, which was considered by the Patent Office (5 R. 3933; off., 2 R. 1226).

The real question is whether these and the other broad claims were invalid for lack of invention, as the Court of Claims concluded.

Claim 6 is a typical claim for transmitting circuits and claim 14 is a typical claim for receiving circuits. They are as follows:

> "6. At a transmitting-station employed in a wireless-telegraph system, the combination of a transformer whose secondary is connected to an open circuit including a radiating-conductor at one end and capacity at the other end, and whose primary is connected to a condenser-circuit discharging through a means which automatically causes oscillations of the desired frequency, and means for adjusting the oscillation period of each of the two circuits connected

with the transformer to bring them into accord with each other, substantially as described."

"14. At a receiving-station employed in a wireless-telegraph system, the combination of an oscillation-transformer, an open circuit connected with one coil of said transformer, said circuit including an oscillation-receiving conductor at one end and capacity at the other end, a wave-responsive device electrically connected with the other winding of the oscillation transformer, and means for adjusting the two transformer circuits in electrical resonance with each other, substantially as described."

F. The Tesla, Lodge and Stone prior art.

In considering the patents urged against the Marconi patent, it is important to appreciate that they were disclosures and teachings as of their date, and not of today. There are now thousands of radio engineers, and probably great numbers of high school boys, who could take almost any early radio patent and, selecting a part, combine it with some parts from other radio patents, so as to produce a modern device. But that is because before they saw the patents they had been educated so that they knew the right thing to do. Problems once solved are not difficult, and there are many things which seem plain, natural and obvious after they have been done. It is easy to look back and see what should have been done—it is another matter to select the right course in an uncharted sea.

The Court of Claims based its views (finding, 1 R. 59; opinion, 1 R. 96 *et seq.*), that the broad claims of the Marconi patent were invalid, on the Tesla and Lodge patents and Stone documents, reproduced in the record here. It is not quite clear whether the Court thought that the Tesla

patents alone fully anticipated the Marconi claims, or whether a combination of Tesla, Lodge and Stone made the Marconi claims invalid because their subject matter was or should have been obvious to those in the radio art of that day. In either case, on a fair reading, these papers do not support the Court's conclusion.

1. *The Tesla patents.*

The Tesla patents 645,576 and 649,621 are based on a patent application filed September 2, 1897, which was divided, the first patent issuing on the original application and the second patent on the divisional application. The two patents describe the same method and apparatus, having the same illustrative drawings, method claims being in the original patent and apparatus claims in the divisional patent (5 R. 3602, 4089).

Although the proposed method is, in a broad sense, a "wireless" method, it is not one using radiated (Hertzian) ether waves, and the apparatus is not intended for or useful in such a system.

The Marconi and all other useful wireless systems operate by an antenna producing ether waves, which radiate out through the nonconducting and insulating air until they meet an antenna which converts them into currents. As distinguished from this, Tesla proposes to electrify the air, changing it from a non-conducting condition to a conducting state, so that currents at the sending station will run across the conducting air strata, as along a wire, to the receiving antenna. The electrification was to be accomplished by producing very high voltages, millions of volts, at the top of the transmitting antenna.

The Tesla apparatus was designed to carry out this method, and as we shall show, it was adapted to produce

large currents and high voltages, but not to perform in a Hertzian wave or radiation system.

Even a casual reading of the original patent 645,576 (5 R. 3002) discloses its Jules Verne nature.

The patent commences with some observations on the so-called Crookes tube, containing gas, which, when rarefied and electrified by a high voltage, became conducting so that it would carry a current. From this Tesla concludes that gases conduct better when electrified and that "the conductivity imparted to the air or gases increases very rapidly both with the augmentation of the applied electrical pressure and with the degree of rarefaction" (p. 1, ll. 65-69). For example, says Tesla (p. 2, l. 80) "it has long been known or surmised that atmospheric strata at great altitudes—say fifteen or more miles above sea-level, are, or should be, in a measure, conducting" (a something less than positive statement).

However, as Tesla could not reach this extremely rarefied and high strata, he proposed to electrify lower strata, and thus make them conducting, even better than "a copper wire of a practicable size" (pat. p. 3, l. 101), by using a high antenna with millions of volts at its top. For example, the patent says that using antennas of about thirty to thirty-five thousand feet high and electrical pressures of fifteen or twenty million volts, "the energy of many thousands of horse-power may be transmitted over vast distances, measured by many hundreds and even thousands of miles" (p. 4, l. 132, *et seq.*).

The Tesla patents are plain that they describe a current-conducting method and not radiation of ether waves. The original patent distinguishes its method "from other known methods of transmission . . . based, in so far as the

atmosphere is concerned, upon those qualities which it possesses by virtue of its being an excellent insulator" (p. 2, l. 65, *et seq.*), namely, a non-conductor, as it is in radio communication. The same statement is expressed in the divisional patent in different words (p. 2, l. 73, *et seq.*) as follows:

> "It is to be noted that the phenomenon here involved in the transmission of electrical energy is *one of true conduction* and *is not to be confounded with the phenomena of electrical radiation* which have heretofore been observed and which from the very nature and mode of propagation would render practically impossible the transmission of any appreciable amount of energy to such distances as are of practical importance."*

Turning now to the apparatus by which Tesla produces the very large currents to carry the energy and also the millions of volts to make the air strata conducting:

This apparatus is shown in the single drawing of both Tesla patents. No tuning is shown in the drawing. Referring first to the original patent, which contains the fullest description, its explanation of the drawing does not contain a word about tuning (p. 2, l. 122 to p. 3, l. 85). There is a primary circuit, containing a source of alternating currents, G, and a coil C, which is the primary coil of a transformer. There is also a secondary circuit, which is an open circuit, containing a vertical conductor B with an upper terminal D and a coil A, which is the secondary of the transformer. Energy in the primary circuit may be transferred across the transformer to the open circuit. By this apparatus, large currents of fairly high voltage are pro-

*Italics in quotations are ours throughout unless otherwise stated.

duced in the primary circuit, and are transformed into currents of much higher voltages in the wire, whose terminal D electrifies the air strata, along which the currents run to a similar receiving system.

If Tesla had considered that tuning was essential, or even important, to producing his currents or voltages, he would have said so in describing this apparatus.

However, the patent also describes "a model plant which has been long in use and which was constructed for the purpose of obtaining further data to be used in the carrying out of my invention on a large scale" (p. 3, l. 108, *et seq.*), and this very peculiar experimental device did have a kind of tuning. This apparatus comprised a fifty foot tube of rarefied air, with a transmitting terminal in the tube at one end and a receiving terminal at the other end of the tube. The voltage in the primary circuit was 50,000 volts, the primary coil had one turn, the secondary coil had fifty turns and the secondary voltage was 2,500,000 volts (fifty times 50,000), the voltages at the terminals being "from two to four million volts" (p. 4, l. 30). In connection with this fifty foot, several million volt, apparatus, tuning is referred to. Tesla proposed tuning the circuits, to produce high voltage to electrify the air, but not to increase the currents nor for any other purpose.

> "The primary and secondary circuits in the transmitting apparatus being carefully synchronized, an electromotive force from two to four million volts and more was obtainable *at the terminals*" (Tesla pat., p. 4, l. 27, *et seq.*).
>
> "The results were particularly satisfactory when the primary coil or system A', with its secondary C', was carefully adjusted, so as to vibrate in synchronism with the transmitting coil or system AC" (p. 4, l. 40, *et seq.*).

> "The high electromotive force obtained *at the terminals* of coil or conductor A was, as will be seen, in the preceding instance, not so much due to a large ratio of transformation as to the joint effect of the capacities and inductances in the synchronized circuits" (p. 4, l. 60, *et seq.*).
>
> "a transmitting and receiving coil, or conductor, both connected to the ground and to an elevated terminal and adjusted so as to vibrate in synchronism" (p. 5, l. 49, *et seq.*).

The plain purpose of this synchronization (tuning) was to produce the millions of volts which Tesla thought would make conductive the high air strata. There was no tuning of the wire circuit to produce more powerful ether waves or a more selective ether wave (Tesla repudiates ether waves). Indeed, the great length of the wires proposed by Tesla, "thirty to thirty-five thousand feet above the level of the sea", which was "a comparatively-small elevation" (Tesla pat., p. 5, il. 2-4), would prevent tuning (Weagant, 2 R. 1641; Hogan, 3 R. 1862; *National* opinion, 213 Fed. 847).

The Tesla divisional patent has a shorter description of what was in the original patent, and contains claims to the apparatus described in the original patent. There is nothing in this patent concerning tuning one antenna circuit to another circuit in the same system, but only to tuning the transmitting circuit as a whole to the receiving circuit (p. 1, l. 98, *et seq.*).

The Court of Claims says (finding, 1 R. 39) that the Tesla original patent

> "instructs those skilled in the art that the open and closed circuits of the transmitting system and the open and closed circuits of the receiving system of

the Tesla patent, should be in resonance with each other, or, in other words, that all four circuits should be in resonance.

"Such teaching is further implied in Tesla patent #649,621, based on a divisional application of the above-named Tesla patent in which it is stated, beginning with line 97, page 1, that 'it will be readily understood that when the above-prescribed relations exist the best conditions for resonance between the transmitting and receiving circuits are attained, and, owing to the fact that the points of highest potential in the coils or conductors AA' are coincident with the elevated terminals the maximum flow of current will take place in the two coils, and this, further, necessarily implies that the capacity and inductance in each of the circuits have such values as to secure the most perfect condition of synchronism with the impressed oscillations.'"

The vital error in the Court of Claims' reasoning was that it did not understand that Tesla synchronizes only for the purpose of obtaining his tremendously high voltages, at the terminals, so that the air could be made conducting. For example, in the divisional patent, the system and apparatus is described without a word concerning tuning (resonance) except the portion above quoted in the court's finding, and there Tesla is referring to his specific example, composed of "the above-prescribed relations" in which there is not a word regarding tuning. The "relations" include "a secondary of fifty miles in length", and adjusting the length of wire so that "the points of highest potential are made to coincide with the elevated terminals DD'" (p. 1, l. 88, *et seq.*). There is not a word about the two things which determine tuning, namely, capacity (condensers)

and inductance (coils), but only the frequency of the currents, the potential and the length.

The Court of Claims also says (opinion, 1 R. 97):

> "Just what method he [Tesla] proposed to use for synchronizing the circuits is not stated, but Lodge had shown how it could be done by the system of adjustable inductance and as we have specially found (see Finding LXII), anyone skilled in the art was capable of applying the Lodge method of tuning to the Tesla system."

The Court of Claims said after the Tesla and Lodge patents "were issued it was only necessary to put them together to have the Marconi system" (opinion; 1 R. 98). But the Patent Office and the other courts were right in concluding otherwise, especially as the Tesla ideas would not have appealed to an intelligent reader, who would doubt the extraordinary statements made by Tesla that it was possible by his system to transfer electrical energy "in quantities suitable for industrial uses on a large scale up to practically any amount and, according to all the experimental evidence I have obtained, to any terrestial distance" (pat., p. 2, l. 60, *et seq.*), this being based on experiments with a fifty-foot tube (*id.*, p. 4, l. 14).

In the French litigation, the decision considered the Tesla French patent corresponding to the United States Tesla patents here (4 R. 2661 *et seq.*) and also the Tesla patent 645,576 (p. 2688), with respect to which the court says (p. 2672)

> "whereas doubtless vague references are made therein to the transmission of intelligible messages, but the language being, so to speak, with evident intention couched in vague terms, cannot be considered as imparting to the patent the character of a wireless telegraphy invention; moreover it is diffi-

> cult to see how a device capable of conveying currents at a high voltage, and intended for continuous lighting or motive action, could be made suitable to the special requirements of transmitter and receiver, providing the intermittent but repeated action requisite for the working of wireless telegraphy with manipulators;"

In the *National* decision, 213 Fed. 815, Tesla is discussed and it is pointed out that his antenna could not be resonant, although the transformer might, and that "Tesla's conception seems to be entirely remote from the subject-matter of the patent in issue" (p. 857).

In the *Kilbourne & Clark* opinion in the district court, 239 Fed. 328, Tesla's book and his patent 649,621 are referred to (pp. 334, 337), but the court sustained the claims of the Marconi patent, saying (p. 335): "To reconcile persistency of oscillations and amplitude of vibration in the radiator was a real accomplishment." The appellate court's opinion refers to the Patent Office consideration of the Tesla patents (265 Fed. 659) and says (661): "we find that the claims of the [Marconi] patent may be sustained for the combination of elements such as are found typical in claims Nos. 6, 14, 10 and 20 for both transmitting and receiving apparatus."

The Tesla patents did not describe the invention of the Marconi patent, they did not teach it to anyone, they did not lead to anything practical, and they did not anticipate or invalidate the Marconi patent.

2. *Lodge.*

The Lodge patent 609,154 (4 R. 2579; off., 1 R. 190) was applied for and issued in 1898, and describes a wireless communication system, operating by Hertzian waves.

The invention consisted in tuning the antenna, by means of an inductance coil, so that the transmitting antenna would transmit longer trains of waves and also the length of the waves would be increased. Thus interference between messages can be greatly reduced (Waterman, 1 R. 330, *et seq.*).

The Lodge patent describes in Fig. 1 a single-circuit transmitting antenna and a single-circuit receiving antenna, each being tuned. Fig. 4 is a tuned transmitting antenna circuit with a closed coupled circuit, *not tuned*, and Fig. 13 is a tuned receiving antenna, with a coupled closed circuit, *not tuned* (Hogan, 1 R. 1864; Weagant, 2 R. 1629; Waterman, 3 R. 1929; *National* opinion, 213 Fed. 857).

Sir Oliver Lodge was a great scientist, who knew as much as, if not more than, any other worker in the radio field. He was thoroughly familiar with Hertz's work, believed that Hertzian waves could be satisfactorily utilized, made many experiments on radio waves, and delivered lectures in 1894 on this subject, including discussions of transmitting and receiving antennas, tuned circuits, etc., (deft's ex. E-4, 5 R. 3872; off., 2 R. 867).

But Lodge did not make the Marconi invention, and the sensible view of Lodge's work is that it establishes, not negatives, invention in what Marconi did.

The British court referring to the Lodge patent, said (4 R. 2546)

> "This, in my opinion, is exceedingly strong evidence that Marconi's 1900 invention was not so obvious as to deprive it of subject matter Here was Lodge, an electrical engineer of first rate ability, actually devising means to get over the difficulty he had himself explained in his first lecture (1894), the

> difficulty that a good radiating or absorbing circuit is a bad oscillating circuit and a bad conserver of energy. To get over this difficulty, he is making a compromise at both ends by partially sacrificing the radiating or absorbing qualities of his aerial. He introduces two circuits at the receiving end, and yet he does not see that if only he utilized the principle of resonance, as between those two circuits the problem would be solved, at any rate at the receiving end, and really the problem at the transmitting end is the same problem from the reverse point of view. The common knowledge of the art was so far as material for the present purpose, the same when Lodge prepared his 1897 specification as when Marconi prepared his 1900 specification. How then can I treat as obvious at the latter date what so able a man as Lodge entirely failed to see at the former date".

The fact that Lodge did not see the desirability of tuning his closed circuit is very convincing that it was not as obvious in 1900 as the Court of Claims in 1935 thought it should have been.

3. *Stone.*

The Stone patents 714,756 and 714,831 (5 R. 3648, 3667; off., 2 R. 865) were considered by the Patent Office before granting the Marconi patent (1 R. 38), and they, with perhaps some letters from Stone to a friend, are relied upon by the Court of Claims (1 R. 99, 100).

Stone believed that an antenna necessarily radiated a complex wave, that is, a wave containing simultaneously a considerable number of different frequencies. He proposed to cure this defect by producing a simple wave in a tuned closed circuit and forcing this simple wave on an untuned antenna, so that the waves emitted by the antenna would be

controlled, as to form, solely by the characteristics of the closed circuit, regardless of the characteristics of the antenna. On the other hand, Marconi, while using a closed tuned circuit in which the currents are produced, also tunes the antenna circuit so that the currents are built up in it and greatly amplified by resonance.

Similarly, at the receiving station, Stone has an untuned antenna and Marconi a tuned antenna, and each has an associated closed circuit tuned to the frequency of the oscillation producing circuit at the transmitter.

(1) *The Stone antenna circuit was not tuned.*

In 1899 Stone wrote some letters (5 R. 3630, 3634; off., 1 R. 733), which described some ideas he had regarding wireless telegraphy, and some months later prepared and filed a patent application, on February 8, 1900 (5 R. 3685; off., 2 R. 865), which resulted in Stone patent 714,756. Stone had worked for several years with the American Telephone & Telegraph Company, and was thoroughly familiar with tuned circuits and resonance phenomena (Stone, 1 R. 755, *et seq.*).

The letters described in rough fashion the system and ideas which later were written and illustrated in the elaborate, carefully worded and lengthy description of his application. There is nothing important in the letters, which is not in the later filed application for a patent.

Briefly, the letters refer to tuned circuits, that is, circuits tuned to the same frequency, but these are closed circuits and not tuned antenna circuits. One of the tuned circuits is at the transmitting station, associated with an untuned antenna wire, and the other tuned circuit is at the receiving station, similarly associated with an untuned

receiving antenna wire. The letters clearly state that the two closed circuits should be tuned and that the antenna should not be tuned (Weagant, 2 R. 1649). For example, the Stone letter of July 18, 1889 (5 R. 3637-8) states:

> "In my arrangement the vibratory current developed in the vertical wire is not due to the oscillatory discharge of the wire, but is due to a simple harmonic electro-motive force impressed upon it which electromotive force produces *forced current vibrations* in the wire which forced vibrations as is well known depend for their period and form only upon the period and form of the impressed force *and not upon the electro-magnetic constants of the circuit in which they are developed as is the case with free or natural vibrations of a system*".

The vertical wire is the antenna, and Stone here says that its currents are forced, and do not depend upon "the electro-magnetic constants" of the antenna. If the antenna were tuned, its currents would not be forced, but would depend upon its "electro-magnetic constants". In other words, Stone does not vary the period or tuning of his antenna, but relies upon his closed circuit to provide the tuning.

After writing these letters, Stone then prepared a patent application, which he filed in February 1900, the Court of Claims pointing out that "The Stone application *as filed* impressed these oscillations upon the open circuit, and therefore used 'forced' oscillations in the open circuit of the transmitter" (finding, 1 R. 51). Marconi thereafter filed his application and the Marconi British patent, corresponding to the one here in suit, became public on May 4, 1901 (1 R. 52). Then Stone in April 1902 amended his application to describe tuning the antenna (5 R. 3723), the

amended parts appearing in the Stone patent (p. 2, ll. 16-29 and p. 6, ll. 62-66, 5 R. 3649, 3653; Court of Claims finding, 1 R. 49).

The Stone patent is substantially the same as the application as originally filed, except for the 1902 statements that the antenna might be tuned. Omitting those statements and referring to the patent, it is plain that Stone taught that the antenna should be untuned, *i.e.*, contain forced oscillations, as the Court of Claims said. The patent first says that "present systems of signalling by means of electromagnetic waves" (p. 3, l. 65), have complex waves, while in his "invention the vertical conductor of the transmitting-station is made the source of electromagnetic waves of but a single periodicity" (p. 3, l. 107), and that when the

> "elevated conductor is aperiodic, it is adapted to receive or transmit all frequencies, and accordingly a single aperiodic elevated conductor may be associated with a plurality of local circuits, each attuned to a different frequency after the manner now well known in the art of multiple telegraphy by wire conductors" (p. 3, l. 117, *et seq.*).

The word "aperiodic" means without a natural period, *i.e.*, untuned, so that it will "receive or transmit all frequencies", Stone producing "what are substantially forced electric vibrations in the vertical conductor in lieu of producing natural vibrations in the conductor, as has heretofore been practiced" (p. 4, l. 48, *et seq.*).

The Stone closed circuit which produces the oscillations to be forced upon the antenna is tuned. The receiving station has a similar arrangement, the antenna being untuned and there being an associated tuned closed circuit (p. 5, l. 12).

Nowhere in the application as filed is an antenna circuit referred to as tuned.

The Stone claims refer to an elevated conductor and to "a resonant circuit associated with said conductor", and there is no statement that the elevated conductor is resonant or tuned.

The Stone patent and letters were before the district court in the *Kilbourne & Clark* case, 239 Fed. 338, 339, which sustained the Marconi claims, but are not mentioned in the opinion of the ninth circuit court of appeals, which however states that it has carefully examined the proceedings in the Patent Office, the opinion of the district court, and others, and "In the prior art, as thus disclosed, we find that the claims of the patent may be sustained for the combination of elements such as are found typical in claims Nos. 6, 14, 10 and 20 for both transmitting and receiving apparatus" (265 Fed. 661).

Summary

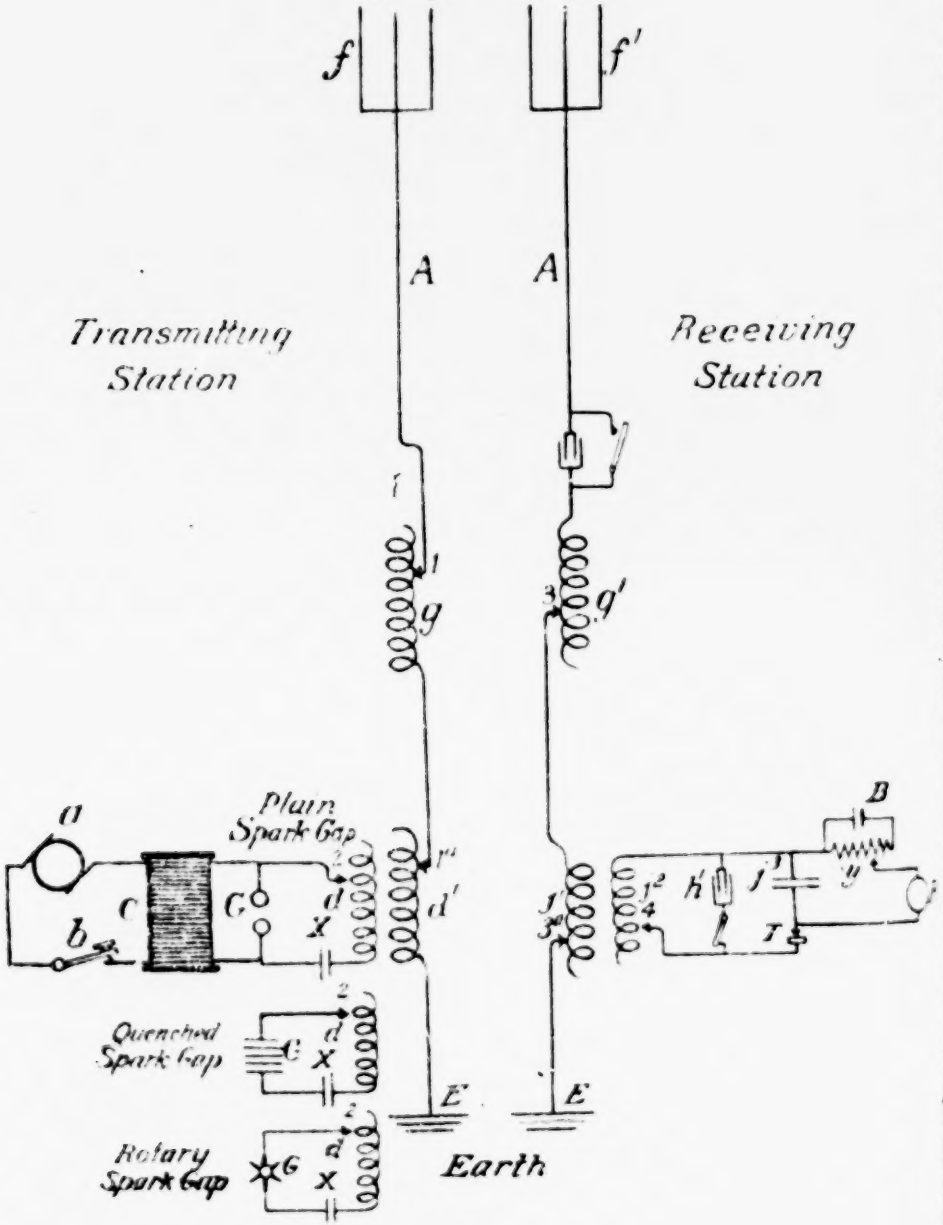
When Marconi in 1900 made his invention, wireless telegraphy was still an unknown land in which the greatest scientists of the times were often at a loss because of their ignorance concerning the fundamental principles, as well as how they could be usefully applied. Edison, Fessenden, Pupin, Lodge, Tesla, and many another were attempting in some way to solve the problem of satisfactory communication without wires.

The record is undisputed that the Marconi invention did solve this problem, changing radio communication from a haphazard, unreliable system covering perhaps 80 miles, to a practical commercial business, operating over many thousands of miles, and the invention going into practically universal, if not universal, use.

PLAINTIFF'S EXHIBIT No. 105

National Electric Signalling System

(Enjoined)



Tesla, Lodge, Stone, and many others came near to Marconi's solution, and it is possible to take parts of some of the things they described and, with some changes, construct from them the Marconi system. But this is not the test of validity, because otherwise no valid patent ever could be obtained for a new and useful combination of old things, regardless of how valuable or unexpected the result would be. And that is not the law, *Keystone Mfg. Co.* v. *Adams*, 151 U. S. 139, 144; *Williams Co.* v. *Shoe Mach. Corp.*, 316 U. S. 364; *Walker, Patents, Deller's Ed.*, 1 Vol. 215, citing cases.

III. The broad claims of the Marconi patent were infringed.

The Court of Claims did not make any ultimate finding of fact as to whether the broad claims of the Marconi patent were infringed, because it considered that they were invalid (1 R. 75). But the opinion and findings show that the Court would have found that these claims were infringed, if the claims were valid, and such finding should have been made.

In the transmitting apparatus charged to infringe, three different kinds of spark gaps were used in the closed circuit coupled to the transmitting antenna, referred to by the Court of Claims as "(a) the plain open-gap apparatus; (b) that having a rotary gap; (c) the larger group using a quenched gap" (opinion, 1 R. 101). These spark gaps are illustrated in plaintiff's exhibit 105 (off., 1 R. 435), reproduced on the opposite page (Waterman, 1 R. 433).

In the closed circuit the high frequency oscillations are created, a spark being produced and extinguished across the

terminals of a gap in the closed circuit, at the frequency of the oscillations, which usually is many hundreds of thousands of cycles a second.

The plain gap had two ball terminals; the rotary had one terminal consisting of rotating studs; and the quenched employed circular plates for the electrodes. Each type of gap had the "property of rapidly cooling and extinguishing the spark," differing in degree (Weagant, 2 R. 1593). The three kinds of gaps operate on the same principle, but the rotary and the quenched would quench the spark quicker than the plain gap, thus enabling the gap to return more quickly to the condition that existed before the spark was created (Weagant, 2 R. 1591).

Many types of spark-gap have been devised before and after Marconi, but they all operated on the same principle with respect to the production of a series of oscillations, each series or group of oscillations lasting while there was a spark discharge across the gap. Whatever type of spark-gap was used, it was essential for high efficiency to get the oscillations in the closed circuit across to the antenna circuit, to be radiated with as little loss of energy as possible. Probably the most important single feature of the Marconi invention was the resonant transfer from the closed to the open circuit, which was both necessary and highly useful, whether the spark gap be of the open, rotary or quenched type (Hogan, 3 R. 1851, 1852).

The type of spark-gap used is immaterial to the question of infringement of the Marconi patent, because its invention relates to tuning transmitter and receiver circuits, and not to spark gaps. The Court correctly found the Marconi patent is not limited "to any specific type of spark producer or oscillation producer" and that the claims in

suit are not limited "to any specific spark producer or to a closed circuit possessing elements which would cause it to function as a persistent oscillator when coupled to the open circuit" (findings, 1 R. 43). It was the opinion of the Court that "All of the wireless sets of defendant made use of apparatus constructed in accordance with the principle which formed the basis of the patent" (opinion, 1 R. 95, 96).

Specifically, with respect to the three types of spark-gap apparatus, the Court of Claims opinion and findings state:

> "We think it clear that the plain open-gap apparatus would be an infringement if the patent was valid, and we are likewise of the opinion that this would be true as to the apparatus using the rotary gap which, as we think, was merely a variation of the plain open gap and apparently used for the purpose of cooling the terminals used in making the gap across which the spark passed" (opinion, 1 R. 101).

The rotary gap was found to have

> "the dual effect of cooling the spark electrode and effecting a lengthening of the spark and its quenching as the moving electrodes recede from the fixed electrode.
>
> "Such operation causes the primary circuit oscillations to tend to cease and the operation, therefore, approximates that of the quenched gap. The circuits and apparatus utilized by the rotary gap apparatus in the Government installation, with the exception of the spark producer or gap, are identical with those used with the plain gap, and the same condition of resonance between the open and closed circuits exists" (findings, 1 R. 44, 45).

With respect to the quenched gap transmitters, the Court of Claims found that they "are substantially similar

in form and function to those utilized in connection with a plain open gap apparatus with the exception that a closer coupling can be achieved between the open and closed circuits" (findings, 1 R. 43), and also said that the quenched gap was

> "only another device for a spark producer and that Marconi in an earlier patent had shown a somewhat similar contrivance. It also appears that when it was used it was necessary to follow the same method of tuning as before. On the other hand, this device apparently was more efficient than the plain open gap for in a comparatively short time it largely displaced the latter system" (opinion, 1 R. 101).

Other courts have also decided that the type of spark gap was immaterial with respect to infringement, all three types of spark gaps having been found to infringe.

In the *National* decision, all three types were held to infringe (Waterman, 1 R. 433; Hogan, 2 R. 1895), and there was "testimony at length regarding the transmitter with the quenched-gap specifically" (Waterman, 3 R. 1975).

The transmitting apparatus held to infringe in *Marconi Co. v. Atlantic Communication and De Forest Co.*, a contested motion for preliminary injunction, was of the quenched gap type (stipulation, 3 R. 2103, *et seq.*; decree off. 3 R. 2094).

In *Marconi v. De Forest Co.*, 225 Fed. 65 (D.C. S.D. N.Y.), aff'd. 2 Cir., 225 Fed. 373, a contested motion for preliminary injunction, quenched gap transmitters were held to infringe (stipulation, 3 R. 2104, 2107; off. 3 R. 2095).

In the *Kilbourne & Clark* case, there were three types of quenched gap transmitters. One type was that manufactured and sold by defendants to the United States

Government and, therefore, the question of its being an infringement was not passed upon by the court (239 F. 355; 265 Fed. 645). The two other types of quenched gap transmitters, the Simpson mercury valve and the Thomson, were held not to infringe, because they did not depend upon tuning, *Kilbourne & Clark* decision, 265 F. 663, 667, as do depend the transmitters in the present case (Court of Claims finding, 1 R. 43). This difference was pointed out in the Interdepartmental Radio Board's preliminary report, in which it was said (4 R. 2818):

> "In the case of *Marconi* v. *Kilbourne & Clark*, a case in which it was argued that there was no effective transfer of energy from the one circuit to the other, the two being substantially energized simultaneously, and in which at any rate *there was no effective transfer from one to the other due to syntony*, was held not to infringe. This, however, is not decisive of the present issue, as to the use of quenched gaps by the Government in which there is a close coupling and a slight or negligible detuning, and *in which, undoubtedly, advantage is taken of syntony to secure an effective transfer of energy*."

The Court of Claims also found that the Government apparatus relied on resonance (syntony, tuning), saying with respect to quenched gap apparatus (finding, 1 R. 43):

> "Defendant instructed its personnel in manuals distributed both by the United States Navy and the Signal Corps of the United States Army, that the closed transmitting circuit should be tuned in resonance with the open circuit in transmitting apparatus using the quenched gap. A Signal Corps pamphlet of 1916, plaintiff's exhibit 92, page 110, states that, '*Tuning of the closed and open circuits to resonance*

and the determination of the correct coupling between them are the two most important adjustments in a quenched spark transmitter."

The Marconi patent was for a broad invention in the then infant art of wireless communication, and there is no reason to limit it to any particular kind of spark gap, when there is no such limitation in the claims and there are not any prior patents or publications which warrant such action.

The Court of Claims declared that defendant's apparatus infringed the claims if valid, and this should have been expressed in a finding.

IV. Claim 16 of the Marconi patent was valid and infringed.

The Court of Claims found that claim 16 of the Marconi patent was valid and infringed (1 R. 117), and that reasonable compensation for the infringing use was $42,984.93, with interest "as part of the entire compensation" (1 R. 156).

Defendant assigns as error the conclusions as to validity and infringement, but does not question the amount of compensation if claim 16 be valid and infringed (specifications of error, *supra*, p. 8).

A. Claim 16 was valid.

In the opinions of other courts on the Marconi patent, there was no discussion of the specific feature of claim 16, which was natural, because the other claims were broader, and they being held valid, there was no reason for consideration of the narrower claim.

Claim 16 is:

> "At a receiving-station employed in a wireless-telegraph system, the combination of an oscillation-transformer, an open circuit connected with one coil of said transformer, said circuit including an oscillation-receiving conductor at one end and capacity at the other end, an adjustable condenser in a shunt connected with the open circuit and around said transformer-coil, a wave-responsive device electrically connected with the other coil of the oscillation-transformer, and means for adjusting the two transformer-circuits in electrical resonance with each other, substantially as described."

The Court of Claims states that the gist of this claim is "an adjustable condenser in a shunt connected with the open circuit" in a receiver, and that prior to Marconi

> "no such apparatus had ever been used or devised. Being new, if it was useful, it was patentable. Its usefulness, we think, is shown by the fact that the receiving apparatus of the Kilbourne & Clark Company and that made by the Telefunken Company used by the Government embodied this device" (opinion, 1 R. 102).

Stone, a witness hostile to plaintiff, testified (1 R. 819) with respect to the British Marconi patent corresponding to the Marconi patent under consideration here, as follows:

> "The British patent No. 7777 of 1900 discloses the really important advances made in the art at that date. Marconi therein discloses a variable inductance coil in series in the antenna, or aerial structure, conductor, and the tuning condenser in shunt with the primary of the transformer in a tuned secondary of which is connected the detector and tuning condensers and inductance coils. Both

> the condenser in the primary and secondary and tuning inductance coils in the secondary, are made variable for the purpose of tuning the circuits with which they are associated."
>
> * * * * * * * *
>
> "The first very clear and complete exhibition of the use of a continuously variable tuning condenser in shunt to the primary of a transformer in a wireless telegraph receiver, so far as I am aware, is contained in the specifications and drawings of the English patent to Marconi, No. 7777, of 1900."

This condenser in shunt (parallel, as distinguished from in series) is in the receiving system (Waterman, 1 R. 358) shown in Fig. 2 of the drawings of the Marconi patent, the patent stating (p. 2, l. 83) "In a shunt around the primary j' I usually place a condenser h," which is said to be similar to condenser e, described as adjustable (p. 1, l. 92). It is a means "of tuning the circuit (Waterman, 1 R. 356). The Court of Claims points out in its finding LX (1 R. 57):

> "The tables on page 4 of the specification thereof [of the Marconi patent] indicate that the purpose of the condenser connected in shunt with the primary winding of the transformer of the receiver, is to enable the electrical periodicity or tuning of the open circuit of the receiver to be altered."

There is nothing in the prior art disclosing this very useful arrangement, and claim 16 is valid.

In this connection, some testimony taken by defendant during the accounting proceedings should be referred to, as apparently defendant is basing a defense of invalidity upon such evidence.

B. The testimony on the accounting was not material to the issues of validity or infringement.

The Court of Claims first heard, considered and adjudicated the issues of validity and infringement of all the claims in suit, including claim 16, it being stipulated that the issues concerning amount of compensation should be deferred until after determination of validity and infringement (1 R. 74, 75). This is common practice in the Court of Claims whose rule 39 specifically authorizes the practice.

The Court decided that claim 16 was valid and infringed by certain Kilbourne & Clark and Telefunken receivers (opinion, 1 R. 102), illustrated in the drawings, exhibits 95 and 79 (finding LXIII, 1 R. 60). This was upon the basis of extensive testimony concerning the receivers (Waterman, 1 R. 369-435; Clark, 2 R. 1488-1511; Weagant, 2 R. 1591-1620; Waterman, 3 R. 1936-1978; Hogan, 3 R. 1878-1912) and in the accounting proceedings, the only receivers that were held liable to account under claim 16 were Kilbourne & Clark, Telefunken and similar receivers.

At no time did defendant move for a rehearing or for leave to offer new evidence concerning claim 16.

During the accounting proceedings, defendant offered in evidence a Pupin patent 640,516 (which had been in the prior record on the issues of validity and infringement, as defendant's exhibit U-2), not as attacking the validity of claim 16, but merely "to show the function of the condenser h in the Marconi patent, and the difference between that function and mode of operation and the function and mode of operation of corresponding condensers in the prior art and in the defendant's device" (defendant's counsel, 3 R. 2376). The Commissioner received it, on the understanding that "it does not in any way attack the validity of claim 16 of the Marconi patent in suit" (3 R. 2377).

On the same basis, defendant also offered a Fessenden patent 706,735 (which also had been in the prior record as a part of plff's. ex. 171), defendant's counsel stating (3 R. 2381): "But here I offer it, not to show invalidity but as showing justification for the defendant's use." There was then some testimony by defendant's witnesses concerning the Pupin and Fessenden patents.

Defendant cannot attack by this testimony the prior decision of the Court of Claims that claim 16 was valid and was infringed by the Kilbourne & Clark and Telefunken receivers. That could only be done by application to the Court to reopen and reconsider its former decision, which was not done. The Court of Claims correctly said:

> "Evidence of the prior art can find no initial entrance into the case through the accounting. The place of prior art in patent law is to invalidate or limit the scope of the patent. The suggestion that it can be introduced for the first time in the accounting for the purpose either of modifying or of interpreting the infringement adjudication is not sound" (opinion, 1 R. 177).

The only possible effect of this testimony might have been to limit the accounting to only the adjudicated types of receivers, but as only those and similar receivers were held liable to account, the testimony was worthless. The Court of Claims in its decision on the accounting proceedings said (1 R. 177, 178):

> "It is clear from the record that the construction and mode of operation of the additional receivers were similar to the Kilbourne & Clark receiver and the Telefunken receiver when the antenna tuning condenser was connected in the parallel position.

> None of the defendant's witnesses has asserted to the contrary, and we have so found in Finding 24."

Claim 16 was decided by the Court of Claims, on a record including the Pupin and Fessenden patents, to be valid and infringed by certain apparatus. Defendant did not attempt to reopen that decision. The accounting was solely to determine how many of the adjudicated types of apparatus had been used, and what was a fair compensation for them. The evidence on the accounting was rightly held by the Court of Claims incompetent as to validity or infringement.

C. The Kilbourne & Clark, Telefunken and similar receivers infringed claim 16.

Findings 23 and 24 (1 R. 139) and the illustrative drawings of the Kilbourne & Clark and Telefunken receivers (1 R. 140) show that the receivers in question employed the shunt condenser and the other features of claim 16, and that the Court rightly found that the claim was infringed by these receivers.

V. The Fleming patent, 803,684, was valid.

The Fleming patent 803,684, application filed April 19, 1905, was granted November 7, 1905. Claims 1 and 37 are in suit. On November 17, 1915, a disclaimer was filed as to low frequency currents, leaving the patent limited to high frequency currents (4 R. 2600).

The Court of Claims decided (1 R. 117) that the claims were not infringed, and said in its opinion that they were invalid because there was unreasonable delay in filing the disclaimer (1 R. 106, 107). The second

circuit court of appeals had previously decided that the claims were valid, that the disclaimer was proper, and that the claims were infringed, *Marconi Co.* v. *De Forest Co.*, 2 Cir., 2 Fed. 560, affirming 236 Fed. 942 (D. C. S. D. N. Y.).

Fleming was the first to discover that a rectifying hot-cathode vacuum tube was useful in wireless communication; that discovery was the genesis of the modern radio art. Practically all modern radio tubes, which are the very heart of radio communication, utilize that discovery.

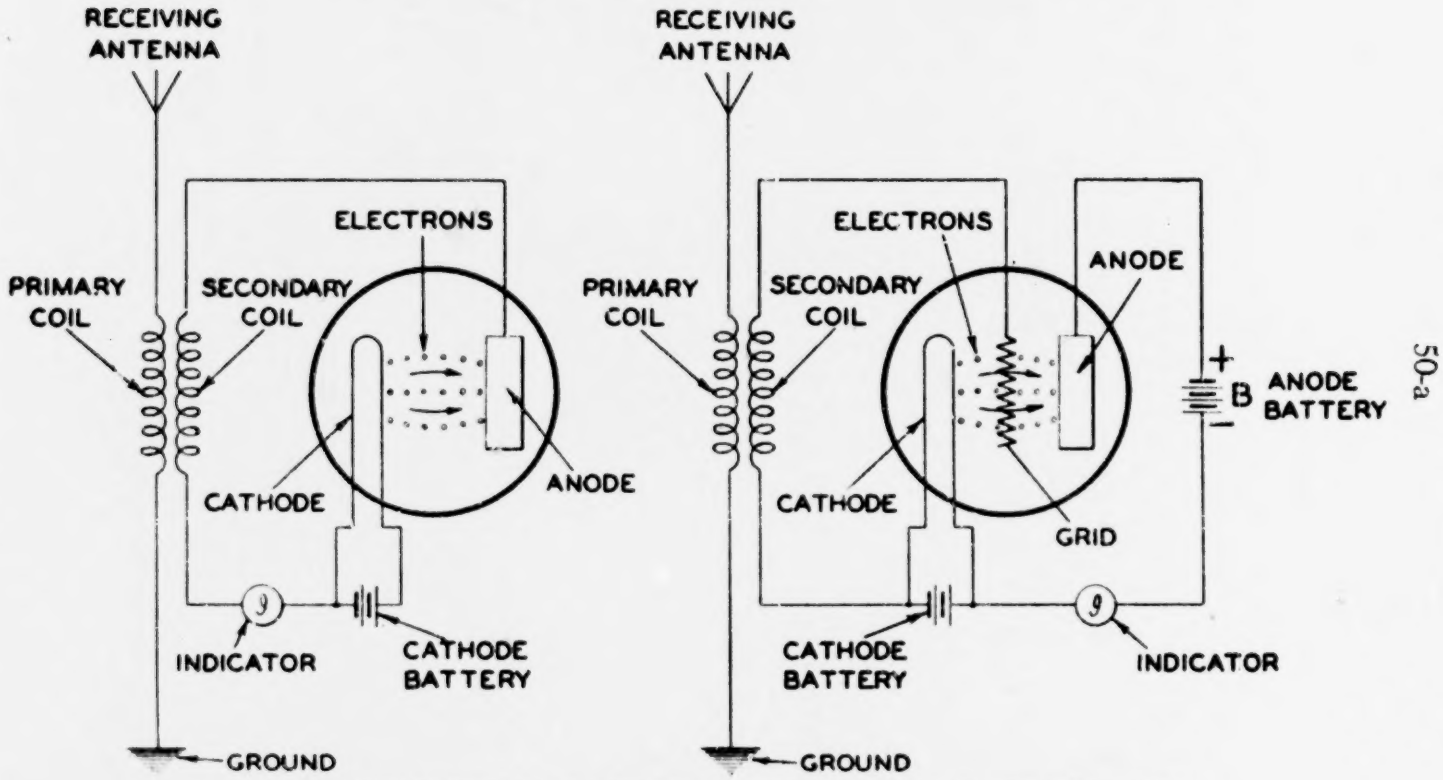
A. Radio tube principles.

This Court has considered radio tubes and their operation in *De Forest Co.* v. *General Electric*, 283 U. S. 664, *Radio Corp.* v. *Radio Laboratories*, 293 U. S. 1, and *Detrola Corp.* v. *Hazeltine Corp.*, 313 U. S. 259. In them some of the basic principles of radio tube operation are stated.

The *De Forest* case involved the amount of vacuum in radio and other tubes, the Langmuir patent in suit there claiming a "high vacuum", and being held to be anticipated by the Fleming patent (283 U. S. 681) and other prior art. The *Radio Laboratories* opinion considered whether Armstrong or De Forest was the first to invent the feed-back or regeneration circuit, used with a three-electrode tube, mentioning that De Forest had added a grid to the Fleming tube, "thereby increasing its capacity as a detector of waves of radio or inaudible frequency and serving better to transform them into waves of audible frequency" (293 U. S. 11).

In the *Detrola* case, this Court discussed the relative merits of a diode and of a triode used as a detector in

DIODE AND TRIODE CHART



SIGNAL VARIATIONS IN RADIO FREQUENCY CURRENTS IN ANTENNA ARE REPRODUCED IN ANODE CIRCUIT, DUE TO A ONE-WAY ELECTRON STREAM IN A VACUUM, FROM THE HEATED CATHODE TO THE ANODE. THE GRID AND ANODE BATTERY AID AMPLIFICATION

modern radio broadcast receiving sets. Diode is another name for the two-electrode tube shown in the Fleming patent, and triode is another name for that tube with the addition of a third electrode, usually called grid, and also sometimes referred to as a De Forest audion, because De Forest contributed the grid. No distinction was made in the *Detrola* opinion between the detecting actions of the diode and the triode, it being pointed out that the diode had the advantage of dispensing with a battery with the corresponding disadvantage of furnishing no amplification, the triode amplifying, but with an additional battery (313 U. S. 263, 264).

There is no difference between the experts as to the essential principles of operation of diodes and triodes (Waterman, 1 R. 436 *et seq.*; Miller, 1 R. 595). Simply stated, their operation is as follows, a chart illustrating them being reproduced on the opposite page.

A diode and a triode each has an evacuated glass bulb, a cathode heated by a current passing through it, an anode, and a circuit outside the tube, connecting the cathode and the anode, called the cathode-anode circuit (sometimes the "plate circuit", because the anode is sometimes called a plate). The triode also has a third electrode inside the tube (called a grid), a cathode-grid circuit and a battery in the cathode-anode circuit.

Both diode and triode depend for operation upon an uni-directional current through the tube, consisting of a stream of electrons emitted by the cathode and proceeding to a cold electrode, which current carries variations derived from the incoming current. The cathode-anode circuit includes a wire outside the tube and also an evacuated space in the tube between the cathode and the anode.

The electrons emitted by the cathode complete the cathode-anode circuit when flowing to the anode, both in

the diode and in the triode. The electrons can flow only in one direction, from the cathode to the anode, and they cannot flow in the opposite direction. Thus the current (electron stream) in the tube is uni-directional (unilateral, one-way), as must be also the entire cathode-anode current, because a part of its circuit, the space inside the tube, is uni-directional.

1. *The process of detection.*

When alternating currents, flowing first in one direction and then in the other, are applied to either a diode or a triode detector, they are rectified, *i.e.* cut in half, because they can flow only one way through the uni-directional circuit. Thus, if a current alternates between one volt plus and one volt minus, when rectified it would vary between either one volt plus and zero, or between one volt minus and zero. This is sometimes called half-wave rectification, because only half the wave of current remains.

The rectified half wave will be repeated in the direct current in the form of variations in its strength (amplitude), in accordance with the form of the impressed currents. These variations are often referred to as pulsations, and also as currents because they are equivalent to alternating currents of the same frequency and amplitude as the pulsations. Technically, they are pulsations, but the art usually refers to them as alternating currents.

When a tube is used in a detector system, the radio frequency currents carrying the signals are rectified, so that the signals appear as audio frequency pulsations in the direct current from cathode to anode, where they can be "detected", by actuating an indicator, such as a galvanometer needle, as in the Fleming patent, or the diaphragm of a loud speaker, as in modern radio broadcast receivers.

The Court of Claims completely misunderstood the nature of detection, and, indeed, the fundamental principles of operation of diodes and triodes, which undoubtedly resulted in its erroneous conclusions concerning infringement. It disregarded all the expert evidence in the case, not only that in behalf of plaintiff, but also that in behalf of defendant, as we shall point out.

The Court of Claims thought that in a diode detector, the diode rectified, and its indicator was operated by *radio* frequency variations, whereas a triode detector did not rectify and its indicator was operated by *audio* frequency variations, there being no *radio* frequency variations in its indicator circuit. The fact is that in both cases there is rectification, both diode and triode have *radio* frequency and *audio* frequency variations in their input and output (indicator) circuits, and their indicators are operated by *audio* frequency impulses.

The Court of Claims said that Fleming's detector made "feeble high-frequency impulses measurable with an ordinary direct-current mirror galvanometer" (finding, 1 R. 63). The "high-frequency" is radio frequency and the "galvanometer" is the indicator. Contrasting the triode and its indicator, a telephone receiver, with the diode, the Court declared:

> "The telephone receiver would not indicate the presence of unidirectional current of constant strength pulsating at *radio* frequencies as would the galvanometer in the Fleming patent" (opinion, 1 R. 71).

The Court also said that Fleming detected

> "by rectification of the full *radio or high*-frequency oscillations impressed upon an indicator adapted to

> register the strength of the rectified one-way pulsating current, while the three-electrode tube in the diagram set out in finding LXXV and marked 'Exhibit 83' detects by substantially suppressing the high-frequency oscillations and amplifying principally the low or audio frequency oscillations" (opinion, 1 R. 111).

But that is not so (Waterman, plaintiff's expert, 1 R. 628; 3 R. 1987; Miller, defendant's expert, 1 R. 606, 607), and it is impossible. The indicator, whether it be a needle, mirror, or the diaphragm of a modern loud speaker, responds only to audio frequency impulses, because these are the signals which are to be reproduced, either by the motions of a needle, seen by the eye, or by air waves, detected by the ear. The radio frequencies, of the order of tens of thousands or millions of cycles per second, are much too rapid for indicators to follow, and even if the indicator could operate at such rates, neither the eye nor ear could observe them. In both the Fleming diode and the De Forest triode, the indicator responds only to audio frequency variations.

And the way that each obtains the audio frequencies is by rectification of the radio frequency currents carrying the audio frequency signals, to produce audio frequency variations, using a one-way directional current which includes the stream of electrons from the cathode.

Defendant's expert witness, Miller, testified with respect to the operation of the Fleming diode detector and the PN (De Forest) triode detector (1 R. 660):

> "In the PN circuit we have two distinct circuits both carrying high frequency currents and low frequency or direct currents. The circuits are distinct and separate because they terminate respectively

> at the grid and plate terminals which are points having different potentials both steady and varying. Radio-frequency voltage variations are applied to the grid, and, as I have explained before, these variations produce through the action of the grid condenser and leak, low or audio-frequency variations of the grid voltage also. Through the controlling action of the grid, amplified variations of both radio and audio-frequency are produced in the plate current of the tube. *The amplified audio-variations affect the indicator I* which is a telephone receiver, the radio variations go to waste in this circuit."

Again, on the same page, he said with respect to "the circuit of Figure 4", which was a triode detector circuit,

> "the incoming oscillations produce, it is true, ***some feeble rectified current pulses***, but only so as to vary the electrostatic potential of the grid electrode. This takes no appreciable power from the received oscillations. There is no indicator for the received oscillations to actuate. The variations in grid potential produce corresponding variations in the plate current which flowing through the indicator produce the response".

With respect to the Fleming diode detector, on the same page, Miller testified:

> "the incoming oscillations are rectified and themselves supply the power to actuate the indicator".

On the basis of the foregoing, Miller says (same page):

> "Thus the detecting action is different in the two devices and the PN circuit, in addition, entails amplification which is a functioning not possessed by the Fleming valve".

Miller is plainly right in saying that the grid enters into the detecting action of the triode. But the point is that the triode, like the diode, uses, and cannot operate without the rectified current through the tube of the applied radio frequency variations, because otherwise the grid circuit would have no audio variations to affect the electron stream and thereby produce audio variations in the current to actuate the indicator.

2. *Amplification, regenerative amplification and oscillation.*

A simple diode cannot amplify, because it merely changes the form of the received currents. A triode can amplify, because of a grid-electron stream amplifying process, with a local battery to provide energy for the cathode-anode circuit. This local battery is additional to the battery for heating the cathode. It may be observed that local batteries were used with the Fleming tube prior to the invention of the triode (Fleming 1905 paper, 4 R. 3140; off., 3 R. 1752) and also with other types of detectors (plff's. ex. 298, 4 R. 3185; off., 3 R. 1800), showing local batteries in Lodge 609,154, Marconi 627,650, etc.). However, these local batteries were not used to amplify.

A very small change of voltage on the grid can produce a larger voltage change in the direct current in the cathode-anode circuit. This is because the grid, through an electrostatic field, acts upon infinitesimally small parts of the current, namely, electrons whose mass is about 1/1700 of hydrogen, the smallest atom. It is as if a river could be diminished at one place to a small rivulet, in which, waves being produced, the whole river would have the same waves.

The grid repeats in the electron stream whatever frequencies are applied to the grid, radio frequencies, audio

frequencies or both (Miller, 1 R. 660). And these same frequencies appear as variations, having the same frequencies, in the direct current which includes the electron stream.

Some tube circuits are used to amplify the radio frequency pulsations (or currents) and others to amplify audio frequency pulsations (or currents). The operation of the tube itself is precisely the same in either case.

From the foregoing, it is plain that when a triode amplifies, it uses the one-way current, including a hot cathode stream of electrons, described in the Fleming patent. The amount of amplification was only about one and one-half times (finding, 1 R. 73), but was increased by the later feedback invention to twenty or thirty times (1 R. 73).

Feed-back, or regeneration, was considered by this Court in *Radio Corp. v. Radio Laboratories*, 293 U. S. 1. Simply, it is amplification repeated many times in the same tube. The incoming currents are amplified by the grid action, appear in amplified form in the output circuit, a part of them is fed back to the input circuit, from where they again go through the tube and are amplified, and so on in a cyclic process, until further amplification ceases due to the resistances in the system (Waterman, 1 R. 446, 497; Miller, 1 R. 646 *et seq.*)

The regenerative amplification above described may be so great that the tube circuits commence to produce their own alternating currents, the tube then being often spoken of as an oscillator tube, because the currents produced are often termed oscillations.

When the tube circuits are oscillating, *i.e.*, producing oscillations, the one-way current through the tube is being employed, as in detection, amplification, and regenerative amplification. . .

3. *A diode can amplify and oscillate without a grid.*

The third electrode inside the tube, usually called a grid, is not necessary for either amplification or for oscillation. Defendant in the present case, as well as the defendant in *Marconi* v. *De Forest*, insisted that a grid was necessary for amplification and for oscillation. Plaintiff in both cases showed that this was not true and that these effects could be produced by gas inside the tube or by an electrical field outside the tube (Weagant, 2 R. 1530 *et seq.*; Waterman, 3 R. 2008-2016, 2019). As plaintiff has never claimed that the Fleming patent describes amplification, oscillations or either such use of gas or external field, or that Fleming knew these things, the joint is not of great materiality. However, it has some importance in showing that the Fleming invention had many potentialities other than its use in a grid tube.

It is plain from the foregoing that the triode, like the diode, depends for its operation upon a hot cathode and a cold anode inside an evacuated vessel, producing a one-way stream of electrons as an integral part of a unidirectional current.

4. *The two-electrode tube, Fleming valve, has been practically used.*

Defendant in the present case, as well as defendant in *Marconi* v. *De Forest*, has contended that a two-electrode tube (diode) has no practical utility. That is not so.

The Court of Claims found that "The Fleming two-electrode valve went into use in a limited way; less than seven hundred Fleming valves having been shipped to various ship and shore stations by plaintiff between 1910

and 1915. These Fleming valves were more sensitive than some types of crystal detectors and less sensitive than other types" (finding, 1 R. 63) and "While in some respects an improvement on the crystal detectors, it did not entirely displace them" (opinion, 1 R. 108).

But the indisputed evidence showed that from 1907 to 1915, which is when the triode with regenerative amplification came in, the Fleming valve was preferred by many wireless operators who had the choice of using other types of detectors, including the crystal, principally because the tube was the most reliable and it was essential to be able to receive continuously weather reports, distress signals, etc. The crystal had the serious disadvantage of having to be readjusted after each message was received and sometimes during reception (Hartley, 2 R. 1403; Reinhard, 2 R. 1424), and the tube was more reliable, although it was more fragile, being made of glass and having a delicate filament. The relative sensitivity of the two was about the same or the tube was somewhat better (wireless operators, 2 R. 1372, 1384, 1387, 1411, 1424).

The Fleming valve detector was employed in many stations, and the names of many American line, British line, German line and privately owned ships, relying on Fleming valves, are listed in the record (2 R. 1360, 1371). A Fleming valve receiver was in continuous communication for about 72 hours with the ships rescuing survivors of the S.S. Titanic disaster in 1912 (Sarnoff, 2 R. 1388).

At least 1,500 valves were manufactured for plaintiff from 1907 to 1915, which was a large number for that early date, and the records which could be found did not show all that had been manufactured (Brennan, 2 R. 1371). The Stanley "Textbook on Wireless Telegraphy" stated that Fleming patented a valve detector in 1904 and "At that

time it was considered so reliable and robust compared to crystal detectors that it was largely adopted on wireless installations by the Marconi Company" (Weagant, 3 R. 1762). About 1915, it was planned to replace all the crystal detectors used by the Marconi Company with the Fleming diode, but this was not done because of "the rapid development of the three-electrode device" (Weagant, 3 R. 1759).

The Fleming diode has been used in modern radio broadcast receivers (Mauborgne, 2 R. 1151), and was considered by this Court in such use, *Detrola Corp.* v. *Hazeltine Corp.*, 313 U. S. 259. The essential rectifier principle of Fleming is still used today, in its original diode form.

Unquestionably, the addition of a modern high vacuum (*De Forest Co.* v. *General Electric*, 283 U. S. 664), a grid, feed-back (*Radio Corp.* v. *Radio Laboratories*, 293 U. S. 1) and many other inventions, have increased greatly the usefulness of the hot cathode type of tube. But all these inventions and improvements have utilized and been based upon the fundamental operation taught and disclosed by Fleming. As this Court said in *Radio Corp.* v. *Radio Laboratories*, 293 U. S. 1, 14, on the point of whether the De Forest feed-back patent was entitled to cover the use of an oscillator as a generator of radio frequencies, despite the possible ignorance of De Forest as to such use:

> "If De Forest's explanations and excuses were to be disregarded altogether, the result at most would be that the apparatus of the coupled circuits had potencies and values more important than the uses that were immediately apparent, potencies and values at least dimly apprehended, and never discarded or forgotten down to the time of their complete fruition

> The benefit of all alike belonged to the inventor. *Corona Cord Tire Co.* v. *Dovan Chemical Corp.*, 276 U. S. 358, 369; *Roberts* v. *Ryer*, 91 U. S. 150, 157; *Stone* v. *Chicago*, 104 U. S. 547, 550; *cf. Lowell Manufacturing Co.* v. *Cary*, 147 U. S. 623, 634; *The Telephone Cases*, 126 U. S. 1, 536; *Robinson, Patents*, Vol. 1, § 81, p. 124."

B. The Fleming patent, and its claims 1 and 37.

The Fleming patent was a pioneer in the radio art, and upon its invention has been founded the marvelous radio industry of today. There was nothing in the wireless art prior to him which taught the invention, set forth in his patent and claims 1 and 37 in suit.

The Fleming patent states (p. 1, l. 11, *et seq.*):

> "This invention relates to certain new and useful devices for converting alternating electric currents, *and especially high-frequency alternating electric currents or electric oscillations*, into continuous electric currents for the purpose of making them detectable by and measurable with ordinary direct current instruments, such as a 'mirror-galvanometer' of the usual type or any ordinary direct-current ammeter".

And (p. 2, l. 102, *et seq.*):

> "It will be understood that when an alternating current is impressed upon a circuit including one of my improved rectifiers, as in Fig. 1, the alternating impulses in one direction will be suppressed and the alternating pulsations in the other direction will pass through the circuit in the form of a pulsating unidirectional current. This pulsating unidirec-

> tional current actuates the galvanometer or other continuous-current-indicating instrument I".

It is this "pulsating unidirectional current", produced by the hot cathode and anode in the tube, whose pulsations actuate the indicator in the output circuit, of either a diode or a triode.

Claim 1 of the Fleming patent, as originally filed, was:

> "The combination of a vacuous vessel, two conductors adjacent to but not touching each other in the vessel, means for heating one of the conductors, and a circuit outside the vessel connecting the two conductors."

On November 17, 1915, this claim was limited to use "in connection with high frequency alternating electric currents or electric oscillations of the order employed in Hertzian wave transmission".

Claim 37 is as follows:

> "At a receiving-station in a system of wireless telegraphy employing electrical oscillations of high frequency a detector comprising a vacuous vessel, two conductors adjacent to but not touching each other in the vessel, means for heating one of the conductors, a circuit outside of the vessel connecting the two conductors, means for detecting a continuous current in the circuit, and means for impressing upon the circuit the received oscillations."

C. The claims were valid.

Radio commenced in 1884 with the discoveries of Hertz and from that time on many eminent scientists worked on devising apparatus which would enable wireless communication, including Marconi, Lodge, Fleming, Fessenden,

Pupin, Edison and many others. But no one proposed the use of a rectifying hot cathode tube until Fleming, who filed a British patent application on November 16, 1904 (finding, 1 R. 63), his United States application for the patent in suit having been filed April 19, 1905.

The closest references are an 1884 Edison patent 307,031 and a 1903 French patent to Vaibrieze 327,687.

Edison patent 307,031.

The Edison patent (4 R. 3295; off., 1 R. 690) describes "a system of incandescent electric lighting" in which there is "a standard lamp" (pat., p. 1, ll. 44, 45), through whose filament passed the ordinary direct current for heating the filament to incandescent. Edison put a plate inside the lamp, which received current, and was connected to a galvanometer needle which would indicate changes in the current, or could "close circuit to electrically-operated devices for accomplishing the automatic regulation of the generator supplying current to the system, or for any other purpose" (pat., p. 1, l. 60 *et seq.*). This idea of thus regulating the voltage of the current supplied to the filament amounted to nothing (Waterman, 3 R. 2027), and taught nothing. Edison was interested in wireless communication, as evidenced by his 1891 patent 465,971 for such a system (1 R. 21), but there is no contention that he ever thought that his lamp had any relevancy to wireless.

In the present case, the Court of Claims refers to the 307,031 Edison patent (finding, 1 R. 64, 65) and declares that "Edison's tube is referred to as the two-electrode tube"; although there is nothing in the record to suggest that it was ever referred to as anything more than the lamp it is, at least until long after Fleming.

Defendant's expert witness testified (Miller, 1 R. 679):

> "At this time [1883] the mechanism underlying Edison's discovery was completely unknown, and the phenomenon was mystifying. It was called the 'Edison effect'. In 1884 Edison obtained a patent on his device, utilizing it as a means of controlling the voltage supply for incandescent lamps."

As has already been pointed out, this "Edison effect" meant nothing to Edison in connection with wireless. And it was as unobvious to others, including many who published papers on it (Waterman, 3 R. 2026). Professor Houston in 1884 gave a paper before the American Institute of Electrical Engineers (5 R. 3459; off., 1 R. 692); Fleming himself, in 1890 had a paper in the Proceedings of the Royal Society, in which for the first time was pointed out the possibility of rectifying alternating current (4 R. 3131; off., 3 R. 1572); in 1897 there was a paper by Howell before the American Institute of Electrical Engineers (5 R. 3459; off., 1 R. 692); a 1904 article was published by Dr. Wehnelt, a great scientist, in the Physikalishe Zeitschrift (4 R. 3515; off., 1 R. 692); and there were many other articles and discussions, but no one knew or suspected that there was any practical usefulness in the "Edison effect", notwithstanding the intensive studies and hundreds of experiments conducted on this phenomenon.

The courts in the *Marconi* v. *De Forest* case were right in their views concerning this Edison defense. The district court said (236 F. 946):

> "Stripped of technical phraseology, what Fleming did was to take the well-known Edison hot and cold electrode incandescent electric lamp and use it

> for a detector of radio signals. No one had disclosed, nor even intimated, the possibility of this use of a device then long known in another art. Cohering filings, magnets, electrolytes, and sensitive crystals *at that time*, failed to give any hint of the utility in this art of the Edison lamp. What led Fleming to his result was his adherence to the theory of the 'rectified' alternating currents."

And the court of appeals (243 Fed. 504):

> "Edison's patent stated a fact and suggested a tantalizing mystery, because even he did not pretend to state or assert that he knew why his 'effect' took place. His disclosure remained (so far as we can discover from this record) a laboratory problem until Fleming applied it (whether with a wrong theory or a right one is immaterial) to a new and very practical field of usefulness."

Valbreuze French patent 328,687.

The Court of Claims correctly found that this 1903 patent (5 R. 3540; off., 1 R. 693) was proposed for use as a rectifier of radio currents and that it had two electrodes in a vacuum tube, neither of which was heated (finding, 1 R. 65). As it lacked the essence of the Fleming invention, which requires a heated cathode to emit electrons, and is a useless device (Weagant, 3 R. 1765; Waterman, 3 R. 2027), the Valbreuze patent argues strongly that the Fleming invention was not obvious.

What Fleming did was invention, as held by the courts in the *Marconi* v. *De Forest* case, relying upon the following and other decisions of this Court.

In *Du Bois* v. *Kirk*, 158 U. S. 58, a Kirk patent for movable dams was upheld, although the structure used was not in itself new, this Court stating (p. 63):

> "It was in fact the application of an old device to meet a novel exigency and to subserve a new purpose."

In *Hobbs* v. *Beach*, 180 U. S. 383, 392, a patent for a machine for attaching strips to the corners of boxes was sustained, though a similar structure had been used previously in addressing machines.

> "Beach did not have before him a machine for attaching strips to the corners of paper boxes, but a machine for attaching addresses to newspapers, and while there is an analogy, there can scarcely be said to be a similarity in these functions."

D. The claims were infringed.

Claims 1 and 37 are infringed by defendant's use of the triodes, both as a matter of substance and as a matter of claim terminology.

Claim 1, as modified by the disclaimer, calls for a vacuous vessel (evacuated glass bulb), heated conductor (cathode), cold conductor (either grid or anode), and a circuit outside the tube, used in connection with high frequency alternating currents. This in terms describes defendant's triodes, whether used in detector, amplifier or oscillator circuits, and, as a matter of substance, they use the gist of the invention, as stated *supra*, pages 52-57.

All of defendant's triode circuits employed, in connection with either the transmission or the reception of high frequency alternating currents, a unidirectional current in a vacuum tube circuit, having a heated cathode to emit electrons which proceed to a cold conductor. It was essential to their operation.

In receiving, the tubes were used in detectors, causing an indicator to respond to the signal variations which are carried by the high frequency alternations, and in amplifiers, causing the received electrical variations to be amplified, in each case utilizing the uni-directional current in the tube circuits.

In transmitting, the tube circuits were used as oscillators, employing regeneration, which also depends upon the uni-directional current in the tube circuits.

The audio frequency amplifiers, using tubes, claimed by plaintiff to infringe the patent, were used as a part of a detector system, in which either a crystal or a tube detector produced audio frequency variations, which were then amplified so that they could be detected by the ear. If the received signal was too faint to be readable, one or two tubes were included in to the detector system, so that the ear could observe the signals (Waterman, 1 R. 448).

Claim 37 is more limited than claim 1, claim 37 calling for, among other things, "a detector comprising a vacuous vessel", etc., and "means for detecting a continuous current in the circuit". So defendant's tubes when used in oscillators, or in amplifiers apart from a detector tube, did not infringe this claim, but did infringe when used in detectors.

1. *The Marconi* v. *De Forest and Radio Audion decisions on detectors, amplifiers and oscillators.*

In the original *Marconi* v. *De Forest* case, one of the principal issues was whether a detector, using a De Forest triode, infringed the Fleming patent, both the district court and the circuit court of appeals so deciding. Subsequently, a motion was made upon affidavits to extend the

injunction to amplifiers and "oscillions" which was the De Forest trade name for oscillators. The motion was granted as to amplifiers, but a trial was ordered as to oscillators and, after the taking of evidence regarding oscillators, it was held that the oscillators infringed claim 1 (4 R. 3246, 3247; off., 2 R. 1340). The Court of Claims disagrees with these decisions, apparently because it thought that there was no substantial issue as to infringement of the Fleming patent in the main *Marconi* v. *De Forest* case, the Court of Claims saying (1 R. 112)

> "both sides represented to the court and agreed that the inherent qualities of the two-electrode tube and the three-electrode tube are the same. This being admitted by counsel, the decision, of course, was based upon that conclusion."

But this agreement was with respect to some De Forest patents, and not the Fleming patent, whose infringement was bitterly contested by defendant, as is very plain from the opinions of the district court, 236 Fed. 951-955, and of the court of appeals, 243 Fed. 564, *et seq.* The Court of Claims was misled by an observation of the court of appeals in the *Marconi* case in considering the question of infringement of certain counterclaim De Forest patents, not in suit here, where it was said (243 F. 565):

> "While not accepting such view of the law, we shall first ascertain what visible objects plaintiff has made, sold, or used *which are said to infringe the counterclaim patents*. The detectors called by defendant 'Marconi's earlier infringement' or the 'two-electrode audion' are especially complained of, though, *since it is agreed that the 'two' and 'three'*

> *electrode audions operate on the same basic principle*, no reason appears why defendant must not contend that the same things which admittedly infringe the confessed patents also infringe the counterclaim patents".

But this had nothing to do with the question of whether the diode and the triode operated on the principle of the Fleming patent, but instead, whether the ideas of certain De Forest patents, the subject of a counterclaim by the De Forest Company, were used in the Marconi tubes. These counterclaim patents were based on the idea of using conductive gas in the tubes, while it was agreed that the so-called audions of plaintiff, whether two-electrode or three-electrode, operated in a vacuum, by a hot cathode stream of electrons, independently of gas, which was the "basic principle" referred to. As for the Fleming patent, the De Forest Company never agreed that its triodes operated on the same principle as the patented Fleming tube.

In *Radio Corp.* v. *Radio Audion Co.*, 278 Fed. 628 (D. C., Dela.), a motion was made for preliminary injunction upon affidavits, the district court deciding that claim 1 of the Fleming patent was valid and infringed by defendant's tube detectors, saying "I am not satisfied by the present record, consisting largely of *ex parte* affidavits, that the defendant's device, when used as an amplifier, or as a generator of high-frequency electrical oscillations, falls within the scope of either of those claims", and also not deciding whether claim 37 was "invalid for want of a supplemental oath". The opinion is very brief, does not state the reasons for the conclusions, and therefore is of little aid on the issues here. There was no appeal, the decision being in January, 1922, the patent

expiring in November, 1922, defendant having practically ceased business, and any possible recovery of damages not being worth the trouble and expense of further litigation (stipulation, 3 R. 2093).

E. The disclaimer was not filed unreasonably late.

The Court of Claims in its opinion said that there was "unreasonable delay in making the disclaimer * * * and that the Fleming patent must be held invalid for that reason" (opinion, 1 R. 106), but did not so find (1 R. 75, 117). There was no unreasonable delay.

The patent issued on November 7, 1905, and the disclaimer was filed November 17, 1915, shortly before the commencement of the trial in *Marconi* v. *De Forest*.

The controlling principles are stated in *Ensten et al.* v. *Simon, Ascher & Co., Inc.*, 282 U. S. 445, 452:

> "'The same principle which forbids a patentee to assert a right to more than he has actually invented compels him to disavow the right as soon as he discovers that it has been unjustly claimed. Unreasonable delay in disclaiming is thus tantamount to an original fraudulent claim, and through it the patentee loses the privilege of making the amendment by which alone his patent could be saved. The question of unreasonable delay is a question for the court, upon the facts as found either by its own investigation or the verdict of a jury. *Delay begins whenever the patentee becomes aware that he has claimed more than he has invented or described.* In cases where the excess is not apparent at once upon the inspection of the patent by the patentee, the allowance of his claim by the patent office raises such a presumption in its favor that he may rely on its

validity until a court of competent jurisdiction decides that it is broader than his real invention.' *Robinson on Patents* (1890), Vol. II, p. 284."

In the present case, the Patent Office allowed claim 1 and there had been no decision with respect to it before the disclaimer was made. The Court of Claims thought there was unreasonable delay because Fleming in 1890, and others subsequently, had observed the so-called Edison effect. The Court of Claims says (opinion, 1 R. 106):

"Fleming stated further in his patent:

'I have discovered that if two conductors are enclosed in a vessel in which a good vacuum is made, one being heated to a high temperature, the space between the hot and cold conductors possesses a unilateral electric conductivity, and negative electricity can pass from the hot conductor to the cold conductor but not in the reverse direction.'

But this was not a new invention. As stated above, Fleming himself some fifteen years before (1890), in a lecture, showed that the current flowed only in one direction when *an alternating current was used* in connection with the lamp of an Edison apparatus, and discussed the flow of current from the hot negative terminal of the lamp to the cold electrode of the plate, observing that negative electricity flowed from the plate into an additional circuit connected with the lamp. In 1897 similar statements made by Howell and Kennelly were published. In stating this feature in his patent specifications as new and patentable, Fleming *must have known* that he was making a claim that could not be sustained. There could have been no inadvertence in making this statement, and this matter alone would seem to be sufficient to render the Fleming patent invalid."

But there is nothing in the record to show that the Fleming patent was not correct in stating that Fleming discovered what is set forth in the above quotation, and which is also in his 1890 paper (deft's ex. K-1, 4 R. 3445; *off.*, 1 R. 692). Fleming was the first to discover this, and there is no basis in the record for a contrary finding or conclusion. The Court is also mistaken in thinking that this claimed discovery was disclaimed, because it was not, as clearly appears from the disclaimer at the end of the patent. The disclaimer only limited the patent to the use of the diode device in connection with radio frequency currents.

As this Court stated in the *Ensten* opinion, "Delay begins whenever the patentee becomes aware that he has claimed more than he has invented or described". Disclaimers filed after suit has been commenced are not necessarily too late, *Smith* v. *Nichols*, 88 U. S. 112, 117; *Sessions* v. *Romadka*, 145 U. S. 29, 41; *Carnegie Steel* v. *Cambria Iron*, 185 U. S. 403, 435; *France Mfg. Co.* v. *Jefferson Electric Co.*, 6 Cir., 106 F. 2d 605, certiorari and rehearing denied, 309 U. S. 657, 696.

In the present case, the gist of the invention was Fleming's discovery that the phenomenon observable in an incandescent lamp with an interior plate added to it could be utilized in radio communication, by constructing a tube with proper circuits and applying to it radio frequency currents carrying signal variations. The only system described in the patent and the only use of the device disclosed in the contemporaneous 1905 Fleming paper (plff's. ex. 269, 4 R. 3140) was with such currents. Fleming was the first to teach that the Edison effect could be employed as a useful rectifier of either high (radio) frequency or low fre-

quency currents; before his 1904 discovery, this Edison effect was merely a laboratory curiosity. Although claim 1, without a disclaimer, probably would have been held valid and infringed in the *Marconi* v. *De Forest* suit, there was no reason for litigating this question, because the only devices complained of were used with radio frequency currents. It was plain common sense to confine plaintiff's claim to the only things in controversy, by the disclaimer, and thereby avoid unnecessary argument.

The second circuit court of appeals in *Marconi* v. *De Forest*, 243 Fed. 560, 565, said:

> "The contention that Fleming's patent, whatever its original merit or lack thereof, was voided by an unlawful disclaimer, is without substance. The mistake (if there was one) was in claiming something not needed, and the disclaimer abandoned what was not wanted, without broadening or enlarging any claim; it also left the claims fully supported by the original specification. No injury to defendant, or any one else, is shown. The procedure is within *Carnegie Steel Co.* v. *Cambria Iron Co.*, 185 U. S. 403, 22 Sup. Ct. 698, 46 L. Ed. 968, and our former decisions in *Simplex, etc. Co.* v. *Pressed Steel Co.*, 189 Fed. 70, 110 C. C. A. 634, and *Strause, etc. Co.* v. *Crane Co.*, 235 Fed. at page 129, 148 C. C. A. 620."

There was no unreasonable delay in entering the disclaimer.

In any event, the plaintiff, which is suing as assignee of the patentee, is entitled to the benefits of the disclaimer statute without being penalized for delay in filing a disclaimer. The disclaimer provisions are contained in Revised Statutes 4917 and 4922 (35 USC, Secs. 65 and 71). Section 4922 provides that a suit may be brought on a

patent, even if it claims more than it should, by a "patentee, his executors, administrators, or assigns"; that "plaintiff" may not recover costs "unless the proper disclaimer has been entered"; and also "But no *patentee* shall be entitled to the benefits of this section if he has unreasonably neglected or delayed to enter a disclaimer." Thus Congress distinguished between penalizing a patentee, whose knowledge might be such as to make unreasonable the delay in filing a disclaimer, and an assignee or purchaser of the patent, which might not have such knowledge, and which, therefore, is nevertheless entitled to the benefits of the section.

Conclusion

The decision of the Court of Claims should be reversed with respect to claims 1, 2, 3, 6, 8, 10-14 and 17-20 of the Marconi patent 763,772, because they are valid over the prior art and those claims should be declared infringed, as in effect found by the Court of Claims if the claims are valid; the decision below that claim 16 of the Marconi patent is valid and infringed should be affirmed; and the decision below that claims 1 and 37 of Fleming patent 803,684 were not infringed should be reversed, and those claims should be declared valid and infringed.

Respectfully submitted,

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